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VIEWS, NEWS AND INTERVIEWS.

"I beg your pardon," said the passenger in the skull-cap, leaning over and speaking to the young man on the seat immediately in front of him, "but are you not just returning from college?"

"Yes, sir," replied the young man. "I am one of the graduates. In fact, I was the valedictorian."

"I was sure of it," rejoined the other. "I would be greatly obliged if you'd tell me in a few words what is electricity, who wrote "Junius," who the man in the iron mask was, what was the origin of protoplasm, explain the Schleswig-Holstein question, give me the reasons why republics are superior to limited monarchies, and tell me why evil is permitted on the earth."

The new Brighton Avenue Oak Square Electric Line to Newton, Mass., could not accommodate the crowds the first day. The opening of this line makes it possible to ride a distance of eight miles for five cents, and over 11 miles for 10 cents. The building of this line completes a parallel of the Boston & Albany with electric lines from Boston to Spencer. The steam road management needs to wake up.

One of the beautiful sights of suburban Boston is Mr. Fred A. Gilbert, of the Boston Electric Light Company, on his bicycle. Notwithstanding his 300 odd pounds, Mr. Gilbert is a graceful and skillful rider of the wheel of steel.

Sir David Salomons, the English author and scientist, is said to have the largest collection of horseless carriages in Great Britain. He is a member of geological, microscopical and astronomical societies, and particularly prominent among civil and electrical engineers in Great Britain. Both in London and at his country seat, Broomhill, in Tunbridge Wells, he has splendidly equipped laboratories and machine shops; besides which, at the latter place of residence, one may find a small theater, in which he gives magic-lantern exhibitions to illustrate his scientific hobbies. A command of photography is another of his accomplishments.

An insulating material for wires is manufactured by Anderson, of Stockholm, by treating a fatty oil—such as resin oil—with 20 to 30 per cent of concentrated sulphuric acid at a low temperature. To this is added cellulose or moistened cotton, and the whole is heated to 110 degrees centigrade, and pulverized sulphur is added, which is followed by a reaction which completely changes the consistency of the material. A further large quantity of sulphur is added, and the material is then poured into cold water, after which it is rolled between cylinders and combined with rubber, gutta-percha, resin or paraffine, according to the purpose for which it is to be used.

There have been several peculiar trolley accidents in Brooklyn recently. In one instance a young lady had her jawbone broken by the end of the pole of a beer wagon, tearing her face horribly. Again, a boy, frightened by the burning out of a fuse, jumped off the car and was severely cut. He is suing for $5,000 damages.

One Thomas S. Wentworth is president of the South Peacock Mining Company, organized in Berwick, Me., with a capital of $500,000, of which $35 is paid in, to carry on a mining and electric light and power plant. This Peacock company can't do much strutting until some more cash is paid in.

The "Bridging Bell" Patent.

To the Editor of Electrical Review:

Will you kindly inform me through the columns of your valuable paper or by mail whether the "bridge bell" or method of connecting telephones "in multiple" is covered by patent?

I have seen many inquiries of this kind in your paper and, therefore, venture to ask this.

J. W. Lord.

Limerick, Me., June 30.

This patent is owned by the Western Electric Company, New York and Chicago.

TESLA DESCRIBES AN INTERESTING FEATURE OF THE X-RAY RADIATIONS.

To the Editor of Electrical Review:

The following observations, made with bulbs emitting Roentgen radiations, may be of value in throwing additional light upon the nature of

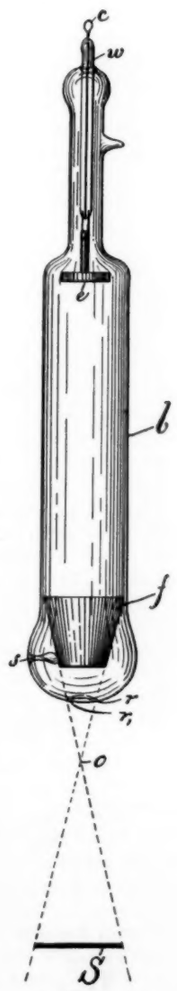


Diagram Illustrating Tesla's Experiment.

these radiations, as well as illustrating better properties already known. In the main these observations agree with the views which have forced themselves upon my mind from the outset, namely, that the rays consist of streams of minute material particles projected with great velocity. In numerous experiments I have found that the matter which, by impact within the bulb, causes the formation of the rays, may come from either of the electrodes. Inasmuch as the latter are by continued use disintegrated to a marked degree, it seems more plausible to assume that the projected matter consists of parts of the electrodes themselves rather than of the residual gas. However, other observations, upon which I can not dwell at present, lead to this conclusion. The lumps of projected matter are by impact further disintegrated into particles so minute as to be able to pass through the walls of the bulb, or else they tear off such particles from the walls, or generally bodies, against which they are projected. At any rate, an impact and consequent shattering seems absolutely necessary for the production of Roentgen rays. The vibration, if there be any, is only that which is impressed by the apparatus, and the vibrations can only be longitudinal.

The principal source of the rays is invariably the place of first impact within the bulb, whether it be the anode, as in some forms of tube, or an inclosed insulated body, or the glass wall. When the matter thrown off from an electrode, after striking against an obstacle, is thrown against another body, as the wall of the bulb, for instance, the place of second impact is a very feeble source of the rays.

These and other facts will be better appreciated by referring to the annexed figure, in which a form of tube is shown used in a number of my experiments. The general form is that described on previous occasions. A single electrode *e*, consisting of a massive aluminium plate, is mounted on a conductor *c*, provided with a glass wrapping *w* as usual, and sealed in one of the ends of a straight tube *b*, about five centimetres in diameter and 30 centimetres long. The other end of the tube is blown out into a thin bulb of a slightly larger diameter, and near this end is supported on a

glass stem *s* a funnel *f* of thin platinum sheet. In such bulbs I have used a number of different metals for impact with a view of increasing the intensity of the rays and also for the purpose of reflecting and concentrating them. Since, however, in a later contribution, Professor Roentgen has pointed out that platinum gives the most intense rays, I have used chiefly this metal, finding a marked increase in the effect upon the screen or sensitive plate. The particular object of the presently described construction was to ascertain whether the rays generated at the inner surface of the platinum funnel *f* would be brought to a focus outside of the bulb, and further, whether they would proceed in straight lines from that point. For this purpose the apex of the platinum cone was arranged to be about two centimetres outside of the bulb at *o*.

When the bulb was properly exhausted and set in action, the glass wall below the funnel *f* became strongly phosphorescent, but not uniformly, as there was a narrow ring *r r* on the periphery brighter than the rest, this ring being evidently due to the rays reflected from the platinum sheet.

Placing a fluorescent screen in contact or quite close to the glass wall below the funnel, the portion of the screen in the immediate neighborhood of the phosphorescent patch was brightly illuminated, the outlines being entirely indistinct. Receding now with the screen from the bulb, the strongly illuminated spot became smaller and the outlines sharper, until, when the point *o* was reached, the luminous part had dwindled down to a small point. Moving the screen a few millimetres beyond *o* caused a small dark spot to appear, which widened into a circle and became larger and larger in the same measure as the distance from the bulb was increased (see S), until, at a sufficiently large distance, the dark circle covered the entire screen. This experiment illustrated in a beautiful way the propagation in straight lines, which Roentgen originally proved by pinhole photographs. But, besides this, an important point was noted; namely, that the fluorescent glass wall emitted practically no rays, whereas, had the platinum not been present, it would have been, under similar conditions, an efficient source of the rays, for the glass, even by weak excitation of the bulb, was strongly heated. I can only explain the absence of the radiation from the glass by assuming that the matter proceeding from the surface of the platinum sheet was already in a finely divided state when it reached the glass wall. A remarkable fact is, also, that, at least by a weak excitation of the bulb, the edges of the dark circle were very sharp, which speaks strongly against diffusion. By exciting the bulb very strongly, the background became brighter and the shadow S fainter, though it continued to be plainly visible even then.

From the preceding it is evident that, by a suitable construction of the bulb, the rays emanating from the latter may be concentrated upon any small area at some distance, and a practical advantage may be taken of this fact when producing impressions upon a plate or examining bodies by means of a fluorescent screen.

N. TESLA.

New York, July 1, 1896.

ELECTRIC RAILWAYS.

The White Line and Wayne & Fifth avenue street car companies of Dayton, Ohio, have consolidated. Capital, $1,100,000; name, People's Line.

The Hartford, Ct., Street Railway Company is making rapid progress on its double track. A temporary change of routes has become necessary. It will probably be a week or more before the usual routes are resumed.

The Dayton Traction Company's new electric road, just opened between Dayton and Miamisburg, is claimed to be the fastest electric road in the United States. It is laid with very heavy steel rails and equipped with the finest rolling stock.

A speed of 70 miles an hour has been easily attained on the extension of the Nantasket Beach Electric Road, the third rail being used. It is said that the complications growing out of the arrangements for switching facilities at stations have finally been overcome on this new road.

Among the cars being built by the New Castle, Pa., Street Car Company is one 36-feet long for the Hagerstown, Md., electric line. It is expected to run at a speed of 40 miles an hour and will carry passengers, baggage and freight. It will contain two 50-horse-power motors and is designed to compete in every way with train locomotives.

The articles of agreement for the consolidation of the Cleveland electric railway companies are said to have been signed by Mr. Mark A. Hanna, of the Little Consolidated, Mr. Horace Andrews, of the Big Consolidated, and Mr. Henry Everett, of the suburban lines, and that as soon as the campaign is over, when Mr. Hanna can give personal attention to it, the details will be perfected. Until then, it is said, the matter will wait.

The court decides, at Trenton, that trolley companies may erect poles in front of private property. The case was that of Mrs. Washington A. Roebling against the Trenton Traction Company. A trolley pole was erected in front of her mansion in West Bate street despite her opposition. The Court of Errors affirms the decision of the Supreme Court, that ordinances granting such rights to trolley companies are not unconstitutional. If Mrs. Roebling can show special damages, the Court says she may find redress by suing to recover.

The Flat Top Central Electric Power Supply and Traction Company, organized at Pocahontas, Va., the past week, and to be incorporated at once with a capital stock of $100,000, will operate a line of electric cars from Pocahontas to Norwood, W. Va., and in addition furnish electric power to the mines of the Flat Top coal field, fully a dozen in number, that are now preparing to put in electric mining apparatus. The operators have found that only the most advanced methods of mining will enable them to continue successfully in competing for the trade of the northwest, where the bulk of their product in the West has been going of late.

It is understood that the Ohio-Indiana, Indianapolis - Logansport and the Clodfelter Gas Belt electric lines have formed a combination, which, after the completion of the Gas Belt line, now under construction between Anderson, Ind., and Marion, and connection with the Ohio-Indiana line at Kokomo or Peru, will give an electric system over 100 miles in length. They intend to compete for through business in passengers as well as light freight. Another electric line is being put through between Columbus, O., and Wheeling, W. Va. The work on the new line between Uhrichsville, O., and New Philadelphia, it is thought, will be completed by the last of August.

Notwithstanding the protestations that the General Electric Railway Company means to enter into active competition with the City Railway's lines, the impression prevails in well informed financial circles, says the Chicago *Post*, that the General Electric will never be built. It is conceded that the ordinance granting the franchise was originally passed with the intent and purpose of selling it to the highest bidder, and it is said that even now it has no responsible financial backing. The difficulties in raising capital for the enterprise at this time are such that the belief grows that the enterprise will come to naught. The statements that Drexel, Morgan & Company, H. Walter Webb and George M. Pullman are interested in the General Electric company lack confirmation and are not taken seriously by those who are familiar with the situation in that city.

Long Branch is on the threshold of another trolley war. There is now an application before the Board of Commissioners asking for a franchise to pass through the town. At a recent meeting of the Board two more applications were filed. The Atlantic Coast Electric Railroad Company, who only recently obtained a franchise from the city authorities for an extension of their lines from Elberon to Pleasure Bay, now asks for a franchise to lay a double track in Broadway, from Second avenue to the western limits of the town. The Atlantic Highlands, Red Bank & Long Branch Railroad Company apply for a franchise to go down Broadway to Morris avenue, and thence across streets and private rights of way to Second avenue. Hearings have been fixed for July 16 and 24. It is understood that bitter opposition will be waged against the granting of either franchise.

A new electric road, to be known as the Wilkinsburg & East Pittsburgh Electric Railway, has been organized. It will connect at East Pittsburgh with the Greensburg, Jeannette & East Pittsburgh Electric Railway, which is now completing a line from Jeannette to East Pittsburgh, the work on which was recently stopped between Jeannette and Irwin by a fight with the Pennsylvania Railroad Company. This will make a through electric route from Pittsburgh to Greensburg, saving several miles via Pennsylvania Railroad. The fare will also be less than one-half that now charged by the railroad company. The stockholders in the corporation are mostly Wilkinsburg people. The officers, as elected by the present stockholders, are: William M. Brinker, president; George W. Black, vice-president; A. W. Duff, Esq., W. O. McNary, Esq., and J. J. Jennings, directors. A. W. Duff is solicitor for the company.

Owing to its inability to make any progress in the negotiations with the Montclair Town Council the New Jersey Street Railway Company, which for the past year has been trying to make some arrangements to build a trolley line through the town, has decided to begin condemnation proceedings at once. The company claims that, under the general traction act of 1893, which has been upheld by the higher courts, it is possible for any street car company to extend its lines upon the payment of damages to abutting property owners, if such can be shown. The proposed proceedings of condemnation has caused considerable uneasiness among the members of the council, and, it is said, a recommendation will be made at the next meeting to take the matter up at once and secure the best terms possible from the company. The citizens favor the company.

An Electrical Aerial Torpedo.

Mr. H. G. Rich, an electrical engineer, of Des Moines, Ia., has invented an instrument of warfare which he calls an "aerial torpedo," designed to be used in the siege of cities, or to scatter large bodies of troops while at rest. The torpedo consists of a small-sized gas-filled balloon, capable of sustaining for any length of time from 30 to 40 pounds at an elevation of from 500 to 1,000 feet above the earth. Inside of the lower or small end of the balloon is placed a metal cylinder, which contains an electrical device, the purpose of which is to ignite the gas in the balloon at any stated period. Underneath the balloon is suspended a case or basket containing high explosives, similar to dynamite, which explodes with terrific force when striking a hard substance like the earth or walled embankments. In action, the management of the torpedo is described as very easy and simple, the inventor stating that a corporal's guard can with it accomplish what would require a large force to do by the usual methods now employed in the siege of cities, or the scattering of large bodies of troops. The torpedo complete is small and compact, and a large number can be carried by a few men or a pack animal. The gas to inflate the balloon is carried in light metal cylinders, enough being compressed in one cylinder to inflate a large number of the aerial torpedoes.

ELECTRICAL ODDS AND ENDS.

The electrical age is just opening and who can tell but that the wildest dreams of the imaginations of the most fanciful may not come true?—*Binghamton, N. Y., Herald.*

Where have we heard this before?

Two Chicago inventors have brought out an electric plow that is expected to stir up the soil on the western prairies with regularity and dispatch. This new plow is practically a low, flat car, resting on two small wheels in front, which communicate with the steering handle, and two broad and rough-rimmed drivers at the rear. The motor, in the center of the car, propels the large driving wheels. The plow knife hangs from the rear and may be raised or lowered by the operator, who sits, in fact, where he can also control the motor and steering devices. The farmers who use these new machines can construct a joint plant for power, with wires leading to the several farms. The invention will not be put on the market for several months, as it will be further improved. It is owned by the Berger Manufacturing Company.

A few miles of the canal trolley system will be built in New York State this year, and next year it will be pushed along as the canal enlargement progresses.

Work on a trolley line in Orange, N. J., was stopped by the town trustees in a unique way last week. The trouble was over the company's attempt to lay a cross-switch to connect the present road on South Orange avenue with the line on Valley street running to Springfield. The trustees ordered Contractor Louis Batt to stop the work, but the latter refused. After trying every possible method to have the work stopped, the trustees sounded a fire alarm. Chief Varsay refused to lend any aid, but some of the firemen volunteered to use the hose on the Italian workmen, which they did, and for over an hour the laborers were kept drenched. In return stones, bolt heads and missiles of all kinds were sent at the firemen, but at last the workmen gave up the fight—mad and wet to the skin.

Underground Ireland is almost unknown. M. Martel, the French cave explorer, proposes to hunt for Irish caves and to examine those he finds thoroughly. He has devised a system of portable ladders, telephones, and electric lights for cave exploration.

The fact that Erie Telephone men are in Postal Telegraph company in Texas has given rise to report that the Postal company would join with the American Bell Telephone Company in a telegraph-telephone. President Chandler, of the Postal, is reported, however, as saying: Erie Telephone people went into our company simply as an investment. We are not going into the telephone business and have no alliance with Erie Telephone Company.

Alternating-Current Mains for Polyphase-Current Distribution.

Professor G. Ferraris, one of the inventors of the polyphase motor, and Professor R. Arno propose in *L'Elettricita* a new highly interesting system of distributing electric energy, embodying the combination of ordinary transformers with a novel kind of phase transformers, by means of which monophase currents can be utilized for the line and polyphase currents for distribution. The phase transformer may be explained as a diphase machine, one of whose windings is fed with alternating currents from the mains. When the armature is made to rotate, currents will be induced in the secondary winding which will differ in phase by about 90 degrees from those in the primary circuit. By properly adjusting the coils of the two circuits, any ratio of transformation can be obtained in this novel machine, which thus justifies its name, phase transformer. No outside energy need be supplied to keep the armature in motion. The transformer, or motor, is started as a monophase machine, the secondary circuit not being closed until normal speed has been attained. The professors describe many different ways in which the phase transformer can be applied.

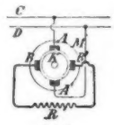


FIG. 1.

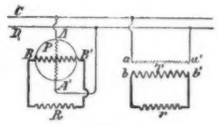


FIG. 2.

Referring to Fig. 1, C D is the high-pressure conductor and M a two-phase motor of which only one phase, A A^1, is connected to the conductor, C D. An ordinary shunt armature is represented by K. If now the armature is set in rotation whilst the coil, A A^1, receives alternating current, an electro-motive force occurs in the second coil, B B^1, whose phase is different by 90 degrees from that in A A^1. If the resistances of the coils are low, a phase difference of almost 90 degrees arises between the terminal pressures of both coils. By suitably selecting the number of turns in A A^1 and

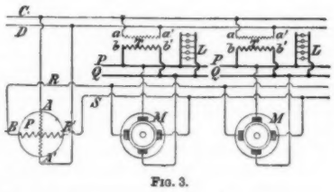


FIG. 3.

B B^1, one can naturally obtain a convenient ratio of conversion in addition to the difference of phase.

The device thus works exactly as a transformer whose primary coil, A A^1, receives current from the conductor, and whose secondary coil delivers current into the conductor, R. The rotation of the armature, K, need not mechanically be effected by means of an external source of power; it suffices, when the motor is run as a single-phase motor on open circuit and when it has reached its full speed, to close the secondary circuit. Then the primary current keeps the armature in motion.

The practical application of the phase transformer will be understood from the accompanying illustrations. In Fig. 2, P is a phase transformer, the primary coil, A A^1, of which receives current from the conductor,

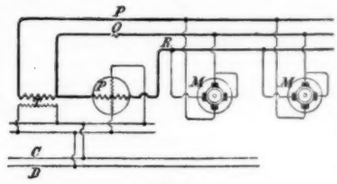


FIG. 4.

C D; T is an ordinary transformer with a primary coil, $a\ a^1$. The current phase in the secondary coil, $b\ b^1$, of the ordinary transformer is thus displaced by almost 90 degrees as against that in the secondary coil, B B^1, of the phase transformer; and if R and r represent the coils of a two-phase motor, the latter can be operated in this manner. Simultaneously with this, as will be seen from Fig. 3, the ordinary transformers, T, feed into the lighting conductors. The motors, M, thus receive one phase from the

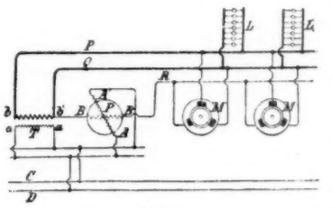


FIG. 5.

conductors, P Q, and the other from the conductor, R S. Instead of using four conducting wires for the motors, three wires can be employed, as shown in Fig. 4.

The application of the phase transformer for the conversion of a single-phase into a three-phase current is shown in Fig. 5. The figuring of the separate parts is the same as in Fig. 4. Fig. 6 illustrates how the two-phase current produced by the Ferraris-Arno arrangement can be transformed into a three-phase current by means of the Scott method of connections. The authors, in conclusion, give a series of other methods of carrying out the desired object.

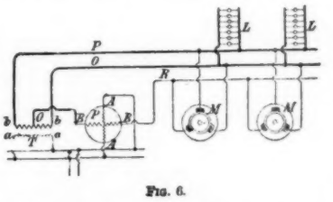


FIG. 6.

A Queen Who Believes in Progress.

Queen Victoria has had several telephones installed in Windsor Castle. They are placed on her majesty's study table and communicate with Lord Salisbury at the Home Office, Marlborough House and Buckingham Palace. In a few days an electrophone will be introduced at Windsor Castle and the Queen will be enabled to hear all the latest entertainments in the London theaters and concert halls. It will even be possible for the royal ears to hear the latest music-hall gags, and that, too, without compromising in the slightest degree queenly dignity.

PERSONAL.

Mr. S. Dana Greene, of the General Electric Company, and Miss Cornelia Chandler were married at Batavia, N. Y., on June 25.

Mr. Morris W. Mead, superintendent of the Bureau of Electricity, of Pittsburgh, and Miss Johanna Louisa Ecker were married at Pittsburgh on June 30. A number of very fine presents were sent the groom by his electrical friends.

Mr. Frank Ridlon, president of the Electric Potential, of Boston, and one of the best known electrical men of the Hub, is a member of the famous Ancient and Honorable Artillery Company, which has just sailed for England. Mr. Ridlon could not accompany the party, but his daughter, Miss Bell Ridlon, and several other ladies formed an agreeable addition to the list of visitors abroad.

Mr. H. J. Medbery, the well known manufacturer of the Medbery insulating materials, so popularly known in electric railway circles, and who is also largely interested in the manufacture of the Warren alternator, comes to New York city nearly every week from his home at Mechanicsville, New York. The Warren alternator, Mr. Medbery states, is meeting with most encouraging patronage.

We regret very much to learn from the London *Electrician* of the sad accident to Mr. Lennox, who has been Professor Dewar's assistant in his many wonderful experiments with gases of low temperature. Mr. Lennox was conducting some independent experiments with acetylene when the cylinder exploded, destroying one eye and severely wounding his face. A cablegram last week to a friend in this country says that he is recovering.

Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, of St. Louis, is spending a few days in New York city, with headquarters at the Hotel Imperial. The incandescent lamp business of his large company is keeping up splendidly during the Summer months, and this enables Mr. Rhotehamel to view the political conventions and the silver discussion with equanimity. The recent tornado in St. Louis did no serious harm to his factory.

The North American Company.

A correspondent asks for the location of the offices of the North American Company and the names of the officers.

In answer, the North American Company is located on 12th floor, Johnson Building, 30 Broad street, corner of Exchange place.

The company recently held its annual meeting, but we do not believe the officers were changed. They were as follows: President, C. W. Wetmore; secretary and treasurer, Edward Edes; directors: The two named and E. Q. Keasbey, J. I. Beggs, S. W. Burt, J. Hobart Herrick, D. S. Wegg, G. R. Sheldon and Henry C. Payne.

Dale Manufacturing Company in Trouble.

The sheriff has taken possession of the place of business of the Dale Manufacturing Company, electrical supplies, at 108 Greenwich street, New York city, on an execution for $1,620, against John H. Dale and Lawrence J. O'Reilly, in favor of the Waterbury Manufacturing Company, for goods sold and delivered.

POWER TRANSMISSION BY POLYPHASE ELECTRO-MOTIVE FORCES.

BY GEO. WHITE-FRASER, BEFORE THE CANADIAN ELECTRICAL ASSOCIATION, JUNE 19, 1896.

(Concluded from page 11.)

This tremendous widening of the field of electrical possibilities has not been attained by natural growth only. As the field widened the science developed; improved methods had to keep pace with increased demand, and while it was originally the demand that stimulated the invention of polyphase currents, polyphase currents have in their turn practically revolutionized the art of electrical generation, transmission and utilization, and the old formula, C. = E. ÷ R., that was a light unto the path of thed irect-current man, is no longer sufficient in the calculation of alternating-current circuits.

It is the development of polyphase working that has rendered commercially possible the electrical transmission of power over great distances, and its reconversion into mechanical power when required. Polyphase currents are merely ordinary alternating currents, are generated separately as such, and possess no peculiar properties in themselves. Owing, however, to their difference in phase, the fields produced by them have different values at the same instant, and it is in this alone that the peculiar properties of the polyphase system reside. As they are, however, alternating currents, all those peculiar phenomena met with in alternating-current work are inherent in polyphase working, and, as a rule, assume an importance which claims very careful consideration. Owing, also, to the combination in the same circuit of several electro-motive forces differing in phase, complications arise which are not present in single-phase circuits. Before proceeding to the consideration of the mutual actions and reactions of these quantities, it may be of interest to trace the progress of evolution of electrical working from direct current, through simple alternating, up to polyphase alternating. Up till quite recently, direct current was the only means of power transmission and distribution; but the limit of pressure necessarily imposed on this method was so low that the cost of copper for large areas or long distances became prohibitive, and recourse was had to the alternating current used with static transformers. By this means, transmission voltage could be as high as required, and utilization pressure as low; but here again was a very vexatious limitation, due to the fact that motors could not be made to operate satisfactorily on the alternating current. Once started and brought up to speed, they would go on until overloaded and then stop; but it required some independent source of power to start them, such as a steam engine. It is quite evident that such motors could not start from rest, as each armature coil was subjected to equal forces acting in opposition to each other, and therefore neutralizing each other. It was like the dead center of an engine. This was the stationary field of an ordinary direct-current motor. This difficulty was overcome by the formation of a revolving field, and polyphase currents are necessary for this purpose. The principles of the revolving field are the same as those governing the resultant of mechanical forces acting in different directions on the same mass. * * * *

I wish to draw your particular attention for a few moments to the retardation of the current behind the electro-motive force, brought about by the induction of lines or apparatus, as it has a most important bearing on the transmission of power. The power or energy of a circuit is, as we know, the product of the amperes into the volts; but owing to this lag the actual power transmitted is less than the amount calculated by multiplying the amperes and volts; and it becomes less in proportion as the lag becomes greater. This will be rendered evident by studying the diagram, where it is seen that the maximum current flow occurs when the electro-motive force has passed its maximum; and consequently at no time can the power of an alternating current circuit containing induction be equal to the power of a direct-current circuit of same data. Quantitatively the power of such a circuit is equal to $C \times E \times \cos a$, where "a" is the angle of lag. This expression follows directly from a consideration of the diagram connecting generator electro-motive force; reactance and effective electro-motive force, where it is observed that the effective electro-motive force equal to the generator electro-motive force × the cosine of the lag angle a. The less the reactance, the more nearly does cos a approach unity, and the less is the power lost in the line. The cosine of the lag angle is called the "power factor" of the circuit, but in figuring the power factor for a particular case we have to take into consideration not only the reactance of the lines, but also that due to the self-induction of transformers and motors, so that the calculation of the resultant power factor of an entire system becomes a somewhat complicated matter. It is an absolutely necessary matter, however, because the generator capacity and electro-motive force have got to be larger than the actual power required at motors, by the amount "x secant a," where x is the amount required of the motors. We first have the line power factor; imposed on that comes that of the transformers, and lastly that of the induction motors; so the resultant power factor is really a quantity to be reckoned with.

In this place it will be apropos to consider that peculiar condition of equilibrium—called resonance—brought about by introducing sufficient capacity into the line to neutralize the inductance. In this extreme case we shall have no reactance, only ohmic resistance; the current will be actually in phase with the electro-motive force, and owing to the fact (as pointed out by Steinmetz) that the capacity electro-motive force will be in the same direction as, and therefore additive to, the impressed electro-motive force, the resultant electro-motive force will be actually higher than the initial electro-motive force. This addition of electro-motive forces might become a serious matter, as tending to ruin insulation on short lines, but is obviated by throwing the line out of balance. To Professor Dunbar is due the credit of first pointing out its possibility.

We have now examined the main features of polyphase circuits, and can go on to the consideration of some of the practical questions that arise in the discussion of any particular case. The voltage of transmission is probably the first question, and it is plain that the higher the voltage used, the less the copper necessary; but it is limited by various practical considerations. The generator electro-motive force is, of course, limited by the construction of the machine, as to whether space permits of more or less insulating material. This can, however, be raised for transmission purposes to any voltage required by interposing step-up transformers between the line and generator. For any high pressure these transformers are filled with oil, which has a high insulating value, and has the advantage that if a spark does jump at any time, the oil flows back, so that the transformer is not permanently injured. On the lines a pressure of 10,000 volts is quite easily handled, the insulators being large, with plenty inside surface, and the copper can be bare. At the other end of the line the voltage can either be reduced at once to that required at lamps or motors, or can be reduced first to a convenient distributing voltage—say 1,000 or 2,000—and then be reduced to the lamp or motor voltage. It should, however, be borne in mind that each such raising or lowering of voltage introduces an appreciable percentage of loss into the general calculation. For instance, if a large step-up or step-down transformer have an efficiency of 98 per cent, then the loss in a pair is four per cent, due solely to C^2R, leakage, and hysteresis, without taking into account that loss due to the lag introduced by the induction of the coils. Another question to be settled is, "what frequency electro-motive force shall be used?" and this is one that I do not think receives sufficient consideration. If we look for a moment at the expressions for hysteresis, induction and capacity, we shall see that all these losses vary directly as the frequency. It would appear, therefore, that it would be vary advantageous to reduce the frequency as much as possible. The reduction of frequency, however, has the counter-balancing disadvantage that it renders necessary the use of larger, heavier, and, therefore, more expensive apparatus, and that if (the current) is to be used for lighting, less than about 40 or 30 alternations per second is appreciable to the eye in incandescent lamps, and less than about 50 in arc lamps. If it is to be used solely for power purposes, then this limit is taken away, and the actual decision should be made on the basis of whether the enterprise can better afford to waste power in the lines, or to increase its capitalization.

A subject of such interest as "electrical transmission" can hardly receive adequate treatment in the limits of a short paper, and I have already trespassed considerably on your good nature; but I desire to very briefly touch on those preliminary considerations which should shape the policy of any such enterprise, and the importance of which appears to be not duly recognized. The engineering features of any enterprise should be not only influenced, but actually decided by commercial considerations. Electricity is not the object, but the means; the object being to make money by the sale of power. The engineering must be decided by the commercial value of this power. Assume a water power 10 miles distant from a manufacturing town, the energy of which is to be electrically transmitted. What loss is to be allowed in the lines? Can we afford to lose a good deal in the lines, transformers, etc., and so reduce the size of our conductors and consequently our construction expense? or would it be better to keep the loss as low as possible, and save the power for sale? Engineering says you can make your loss as little or as great as you please, but commercial considerations say if power is more valuable than money, it will pay to save all the power possible for sale, even at the expense of heavy conductors. If there be a large demand for power at a high figure, and the source of power is limited, it is best to waste as little as possible; if the supply be very large and the demand small, it may, on the contrary, be best to waste much in the lines, in order to reduce the copper cost. Here again commercial considerations are paramount, for it is obvious that, if much power is to be lost in the line, the generators and water wheels must be sufficiently large to furnish this waste power, and therefore cost more money, and a balance must be struck. Once a decision has been arrived at as to the loss allowable, then engineering considerations must settle as to whether it shall be mostly ohmic or mostly inductive, and here comes in the question of frequency. The efficiency of machinery is not sufficiently considered, and yet has a most appreciable influence on operating costs. The conditions under which motors operate are generally such that, although they may be called upon for a comparatively large output now and then, their average load, the work they are required to do most of the time, is greatly less than the above maximum. Consequently it would appear that their efficiency at such average load is of more importance than their maximum load efficiency. If, therefore, in the above case, the supply is limited and the demand great, the half-load efficiency of the entire plant assumes great importance.

I think the above considerations, and others that will no doubt occur to any thinking person, will show conclusively that no transmission scheme should be undertaken blindly. A should not necessarily use 10,000 volts because B does; nor should he follow the engineering features of B's scheme simply because B has found them suited to his conditions. Every case should be considered on its merits, and the results worked out independently. A little or more or less loss does not mean simply a little less or more copper; it means less or more power to sell—larger or smaller generating plant; it means less or more profit. In every enterprise there is a certain combination of machinery, lines, etc., that will secure the maximum of efficiency with the minimum of expense, and this will not be attained by either regarding it from the purely commercial standard of getting the cheapest, or from the purely engineering standard of putting in the scientifically best, but can only be attained by combining the two, and by clearly recognizing the fact that solid commercial principles enter into engineering as much as into pure business.

GENERAL NOTES.

The Elihu Thomson recording wattmeter is used in nearly all the electric light installations in England.

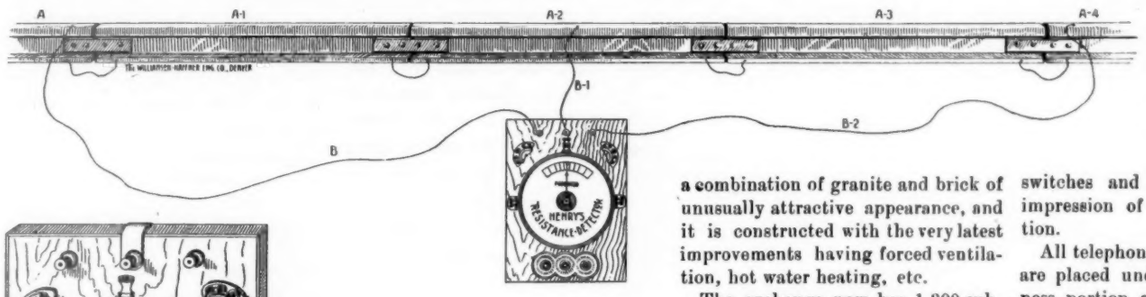
The Western Union wires at Indianapolis are to be buried at once. The telephone wires are expected to likewise come down, after allowing decent delay for preparation for the obsequies.

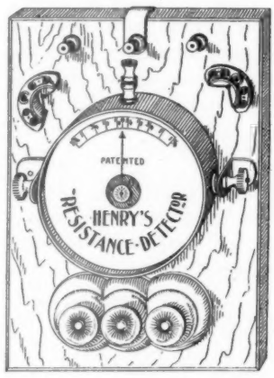
The idea has been suggested in the Machinery Department of the Tennessee Centennial Exposition of separating the steam and power sections by providing two buildings, one containing the boilers, engines and dynamos, and the other the machinery driven by power.

Mr. Charles D. Lanier writes in the *Review of Reviews* for July on "The World's Sporting Impulse," reviewing the marked tendencies of the season toward unusual activity in out-of-door recreations. The cartoons and other illustrations reproduced from the daily and weekly press form an entertaining exhibit of these tendencies as reflected in contemporary journalism.

Method of Locating Defective Rail Joints.

Mr. John C. Henry, of Denver, has invented a system designed to locate defective track rail joints on electric railways. As shown in the drawing, the specially designed differential ammeter is connected by portable leads to the different rails as indicated, and should one of the joints, say, for instance, that at A4, be defective, the instrument becomes unbalanced and the needle will indicate a defect in the direction it





assumes, and also the extent of the defect.

With the instrument, an electrician with the assistance of two boys can readily test and mark all of the defective joints on several miles of track in a day's time, while the cars are running.

Mr. Henry is one of the pioneer electric railway men, and was one of the first to notice the injurious electrolytic effect on the copper bonds which join the rails together. The invention is a modification and an improvement in a method patented by him over a year ago. The indicating device, which he calls a "resistance detector," is made up of a double ammeter. The coils which are connected to the different sections oppose each other. The needle merely indicates any difference between the strength of the two coils, as they may be influenced by the quantity of current flowing through their respective sections. It is expected those instruments will go in the hands of track foremen. They are built so as not to be readily affected by neglect or abuse.

The State Board of Railroad Commissioners has granted an application of the Plattsburgh Traction Company for permission to use electricity as a motive power. The company recently secured authority from the board to build a street surface road to carry passengers to the Catholic Summer school located on Lake Champlain.

The trolley express service in Brooklyn, N. Y., is said to be a great success.

Gold the Currency for American Workingmen.

That the American workingman, therefore, should desire the establishment of the least variable standard of currency seems to be the plainest proposition of common sense. The dollar paid to him in wages should be equal in purchasing power at all times and everywhere to that paid to the owner of a bond. A day's labor is the same in physical exhaustion, whether the compensation for it is in dollars worth 50 cents or in dollars worth 100 cents. What is more important, therefore, to the laborer than that the money standard of his wages shall be as fixed as the labor for which those wages are paid?

When there are two kinds of money, one cheaper than the other, capital will always endeavor to pay labor in the poorer currency, and to secure its own profits in the better. In addition to that, the laborer, under the silver *régime*, would be forever at the mercy of the market manipulators in exchange rates, and every disaster that occurred to depress industry would drive down the price of silver and force up the price of gold. The laborer, however, can not hold his silver money until the market takes an upward turn for that metal. Unlike the rich man, the laborer, having but little money, must pay as he goes. He must part with his wages for the necessaries of life. When the market price of silver is down, he gets so much less for his money. In which currency, therefore, should labor, from any standpoint of common sense, desire to be paid?

Gold in all history has been the one universally accepted medium of international exchange. Until there is some agreement among the countries of the earth for international bimetallism, gold will remain the standard money of the nations. Labor, accordingly, should not be satisfied unless the reward of toil is paid in dollars that everywhere pass current at 100 cents apiece. The American workingman should ponder the fact that poor money is the poorest agency in making poor people rich.—*From "Sound Money the Safeguard of Labor," by the Hon. Rowland B. Mahany, in North American Review for July.*

Electric lines in Europe increased in number from 70 to 111 during 1895, their length from 700 to 902 kilometres (560 miles), and the power from 18,150 to 25,095 kilowatts. Germany leads with 406 kilometres, followed by France with 132 and England with 107, and Switzerland fourth with 47. The only countries still free from electric traction are Bulgaria, Greece and Denmark.

NEW TELEPHONE EXCHANGE AND SWITCHBOARD.

THE LATEST THING IN TELEPHONE SWITCHBOARDS INSTALLED AT WORCESTER, MASS.

On Saturday evening, June 20, the Worcester, Mass., Telephone Exchange was moved to new quarters in an elegant fireproof building recently completed for the purpose, which was briefly mentioned in the ELECTRICAL REVIEW last week. The building is a combination of granite and brick of unusually attractive appearance, and it is constructed with the very latest improvements having forced ventilation, hot water heating, etc.

The exchange now has 1,300 subscribers, and the building is amply arranged for apparatus to handle three times that number of subscribers' stations. While the building in all its elaborate details is an interesting subject, the switchboard has special attraction for the electrical fraternity. It is the first multiple switchboard ever constructed employing automatic signals, and it is unquestionably the most rapidly operating board ever constructed. Not only is an operator enabled to complete the work of making a connection for a subscriber whose call she answers, but the signals are so skillfully arranged that she has constant knowledge of the several connections under her charge. It is not necessary for the operator to listen into the line to determine whether a subscriber has answered his bell nor to find out whether or not he has finished talking, for all this and more is shown her by the lamp signals placed upon the keyboard.

When the subscriber removes his telephone from the hook it lights a lamp upon the switchboard, which indicates that the operator must place a plug in a jack close beside a lighted lamp. The placing of this plug extinguishes the line lamp, and on receiving the number wanted, the operator places the second plug of the pair in the jack of the subscriber to be called, which lights a lamp on the keyboard corresponding to that particular cord, which lamp remains lighted until the called-for subscriber removes his telephone from the hook. This lamp then goes out and the connection is allowed to remain until both lamps in this set of cords light. The operator understands by this that both subscribers have replaced their telephones on the hook, and her duty then is to take down the cords and plugs which automatically extinguishes the lights.

There is no asking, "Did he answer?" "Are you finished?" Nothing whatever is required to be said after the number of the party desired is known to the operator.

It is too early to state how great this improvement in switchboards will prove to be, nor is it certain whether any of the difficulties arising from so radical a change will have any important bearing on future switchboards for large exchanges. The indications, however, are that a great advance has been made over the most perfect switchboard apparatus heretofore employed.

In connection with this office there is a generating plant of no little importance. Sixty large-sized cells of storage battery supply the current for the lamp signals, and they are kept charged by dynamos operated by either a gas engine or electric motor. The generator switchboard, with its voltmeters, ammeters, switches and cords, gives one the impression of an electric light station.

All telephone lines in this exchange are placed underground in the business portion of the city, and are led into the building by under ground conduits. The new switchboard and apparatus connected with it was constructed by the Western Electric Company, and the improvements in it are chiefly the inventions of C. E. Scribner and other well known experts of that company. No little credit for the convenient layout and satisfactory working of the switchboard is due to Mr. I. H. Farnham, electrical engineer of the New England Telephone and Telegraph Company.

The Horseless Carriage.

In fact, it is so thoroughly accepted that the horseless carriage has come to stay, that scores of manufacturers are already engaged in turning out these machines of many and varied types. Their first use will, of course, come in the cities, where there are good roads, and for such purposes as light expressage. The great value of the horseless carriage, as compared with the old style, is its far greater cheapness. The use of horses in our cities, for instance, is practically forbidden to all except the very rich. But a team fed with oil or naphtha, at a cost of a few cents a day, will perhaps eventually place a barouche for afternoon rides in Central Park within the reach of any bookkeeper or clerk. When a man earning $2,000 a year in New York city can maintain an equipage which will trundle him 20 miles away from his flat in an hour, a whole new class of citizens will become victims to the tennis, baseball or golf habit, from which they are now sheltered by the mere inertia of time and space to be overcome. And with each advance in the art of moving rapidly there will be a corresponding increase in out-of-door sports, and a better opportunity to reach the fields and the woods in the short vacations allowed by the hurrying business struggles of to-day.—*Charles D. Lanier in Review of Reviews for July.*

The Cincinnati Street Railway Company will issue $500,000 new stock. Stockholders have privilege to subscribe pro rata at par, which will make capital $11,000,000.

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CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JULY 8, 1896.

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It is one of the instances of the progressiveness of the United States that there is more capital invested in the electrical industry here than in all the rest of the globe. In round numbers there is not less than $1,750,000,000 invested in the industry in this country, not including the capital in the ocean cables.

Is the third rail to supplant the trolley and then grow victorious over the steam locomotive?

We have received from Mr. J. Edward Simmons, president of the Fourth National Bank, of New York, a very interesting pamphlet entitled "Gold, Silver and Paper Money." The little book is sent out with the compliments of the bank, and is a timely and reliable addition to the currency literature of the day.

Two distinguished men have recently tried the X rays with full success in accomplishing desired results—Justice Field, of the United States Supreme Court, and Li Hung Chang, of China. In the first case the exact condition of the knee joint, which was injured by a blow nine years ago, was shown, and the bullet with which an assassin tried to kill the eminent Oriental was located, nicely encysted, in his head. The advantage to the profession of surgery is one of the greatest features of the use of the X ray.

We desire to record our conviction that Prof. Edward Weston, a gentleman whose electrical ability and personal integrity we have always esteemed, is not adding any honor to his name by indulging, through the columns of his journal, *Electricity*, in a personal attack on Mr. George Westinghouse, Jr. The public is never impressed by such publication and soon becomes weary of it. Professor Weston is, if he will but consider, too fair and capable a man to continue on such a line because of an evident personal business disagreement; and the high reputation of Mr. Westinghouse for commercial integrity and inventive and mechanical talent can not suffer one instant, in the minds of those who know him, by any such attack.

Several steam railways, especially in the East, are contemplating an object lesson in the competition of electric railroads which will sooner or later result in forcing the shorter steam lines to adopt the electric current. As an instance, take the Boston, Revere Beach & Lynn Railroad, whose stock recently sold at $50 a share, the lowest price in 18 years. The cause of this low price was the reduction of the dividend rate to a two per cent basis, occasioned by the earnings of the road falling off owing to the competition of electric roads. Heretofore the stock has always paid six per cent or better. It is good opinion that the Boston, Revere Beach & Lynn will soon have to consider an electrical equipment in order to reduce its operating expenses.

PROFESSOR BELL ON AIR SHIPS.

Professor Bell, the inventor of the telephone, takes quite an interest in air ships. According to him, the proper method of propelling the ship would be a trolley in which the rod would hang down to the feed wire instead of extending upward, as it usually does. He is reputed as declaring that the time occupied by inventors in working out the problem of aerial navigation by the use of gas-bag methods is time wasted. We are inclined to agree with Professor Bell. But, whether he is right or wrong, aerial navigation is coming—we feel it "in the air!"—and before the Nineteenth Century closes it will be here, we predict.

MINERAL PRODUCTS OF THE UNITED STATES.

We have received from the United States Geological Survey, Mr. Chas. D. Walcott, director, the report on the mineral products of the United States for the years 1886 to 1895, inclusive. It is full of interesting figures. The output of gold in 1895 amounted in coining value to $47,000,000, while copper for the same year was $38,682,347. This was the greatest output of copper during the 10 years, although 1891 was a close second with an output valued at $38,455,300. Aluminum began in 1886 with an output valued at $27,000, which, however, had increased by 1895 to the value of $464,600. There was produced during the year 1891—the first year it is recorded—tin to the value of $25,058, which increased in 1892 to $32,400, falling off in 1893 to $1,788, and no output thereafter.

Platinum to the amount of 50 troy ounces, valued (crude, San Francisco) at $100, was turned out in 1886. This had increased by 1890 to the value of $2,500, but thereafter fell off until in 1895 it amounted to $900.

The aggregate value of the metallic mineral product for the year 1895 for the United States amounted to the neat sum of $270 453,979; the value of the non-metallic minerals for the same year amounted to $340,341,311, which, with the estimated value of $1,000,000 of unspecified mineral, makes a grand total of mineral output of this country of $611,795,290.

When we consider in addition the vast undeveloped mineral regions of our country, our great natural wealth in this respect becomes a subject of particular interest and importance as well as congratulation.

The *Electric Railway Gazette*, published by the W. J. Johnston Company, of New York, passed from earth with its issue of June 25. There were no mourners.

THE FINANCIAL SIDE.

The stock market suffered very heavy declines this week in consequence of a silver scare created by free silver developments in Democratic ranks, and unduly magnified by bear operators. Prices have declined from 5 to 10 per cent as compared with the high just before the nomination of McKinley. Europe, and especially London, stood under the market all week, taking something like 100,000 shares. It bought cautiously, and when this market moved upward, stopped. As a result, it was able to secure at its own prices some very desirable securities. This buying has practically terminated the gold exporting movement, and places at rest fears of another bond issue this Summer. Home capitalists have showed a marked indisposition to support the stock market, preferring to hold on to what they have pending the outcome at Chicago, rather than to increase their interest even at the current low prices. The sellers were small fry and bears. The market is heavily oversold and the covering process is likely to advance quotations materially early next week. All transactions, barring those from abroad, were of the professional order. Money rates hardened a little owing to the distribution of nearly $100,000,000 in July interest and dividends. Business men have no difficulty in borrowing and their paper is in excellent demand. This does not indicate any fear on the part of bankers as to the immediate future. There is a feeling in the street that the improvement will be in direct proportion to the gain in the McKinley following.

About the only feature in electrical stocks was a sharp break in General Electric on Wednesday, which carried the price down to 24¾ as against the 30, the high on Monday. Subsequently, there was a 1 per cent rally. During the first three days of the week it was figured that some 10,000 shares were sold by one interest very close to the management. It is believed that these transactions did not result in any net loss to the seller, but were made chiefly to create speculative interest in the property at a lower range, with a view of getting it out of the rut in which it has been traveling for several weeks. There is certainly no likelihood that the stock will be advanced against the course of the general market. The debenture bonds were quoted at 88 @ 89.

The exclusive announcement in the ELECTRICAL REVIEW last week that the New Haven road was preparing to install the General Electric third-rail motor on a large number of its branch lines greatly interested Wall street. The company has something like 850 miles of line, fully half of which is local. The development of the trolley and its use throughout New England has cut very heavily into the New Haven's business. The company has hesitated contracting electrical equipment owing to the fact that the trolley, because of the small contact, has not supplied a system efficacious in handling freight. Now that the third rail is shown to be practical, by jumping crossings, its use over lines already established will give the company very great advantages over the street car lines. Mr. J. P. Morgan's connection with both companies is well known, and there is no doubt that General Electric will secure the contract. Just now the New Haven officials are interested in the construction of a new terminal depot at Boston. When this work is under way the electrical equipment matter will undoubtedly be taken up.

Among the inactive electric stocks in which quotations were recorded, was American Telegraph and Cable at 90½ @ 92. Edison Electric Illuminating of New York consolidated 5 per cent bonds sold on Monday at 94.

Dow, Jones & Company say: It can be stated as a fact that both the Westinghouse and General Electric people are extremely pleased with the result of the patent agreement, and, what is more, the net earnings of both companies have under it increased most materially. Users of electrical appliances have in these dull times been particularly hard "shoppers," and this has prevented any radical increase in prices, but the discounts given under competition have been saved, and no goods have been sold at almost cost in order to get a contract as was the case before the agreement was made. BAIN.

New York, July 3, 1896.

A British View of Over-Crowded Trolley Cars.

[*From the London Electrical Review.*]

We have seen it stated somewhere that there is always room for one more on a United States trolley car. That certainly seems to have been the case with a Brooklyn electric car a few weeks ago, for 132 passengers was not a sufficient load for the ambitious conductor. Perhaps he was trying his hand at record-breaking, for he admitted yet another, thus making a grand total of 133; and it is to be supposed that, had not Providence intervened, he might have added further to it. But it was ordered otherwise, for this well laden car ran backward down a hill for one-third of a mile, killing a boy, fatally injuring a woman, seriously injuring six other passengers and slightly injuring nearly two dozen others. It is not an uncommon occurrence for the police in this country to stop an overloaded car, make the standing passengers withdraw and summons the conductor. Not so in America it seems. Oh, what a happy place is Brooklyn!

What a Boiler Explosion Is.

According to an official report, made by a number of German experts, a boiler explosion is thus defined: "The rupture of the walls of a boiler during operation of such an extent as to cause, owing to the escape of water and steam, a sudden equalization of the pressure within and without the boiler."

Andrew Carnegie's Early Life.

[*From the Home Magazine.*]

I obtained a situation as messenger boy in the telegraph office at Pittsburgh when I was 14. This was a transfer from darkness to light, from the desert to paradise, for here I entered a new world, amid books, newspapers, pencils, pens and ink, and writing-pads, and a clean office, bright windows, and the literary atmosphere. I was the happiest boy alive. Really, after this change there seemed little left to be desired, for what more does one want in life, and, indeed, what more can one get that is of much consequence? After he has got these things he has "got it all"; the only tools he needs for anything.

My only dread was that some day I would be dismissed because I did not know the city; for it is necessary, as you can well understand, that a messenger boy should know all the firms and addresses of men who are in the habit of receiving telegrams, and I was a strange boy in Pittsburgh and did not know any. I made up my mind that I should be able to repeat successively each business house in the principal streets, and I was soon able to shut my eyes and begin at one side of Wood street and call every firm successively to the top, then pass to the other side and call every firm to the bottom, and I was finally able to do this with the business streets generally. My mind was then at rest upon that point, but there was another task that was even harder, because it had never been a trouble to me to memorize.

In those days, when the telegraph line broke the "operator" had to start in a buggy to repair it, for the line was along the highway; and he usually took one of the messenger boys with him, who might have to climb a pole. I was always a poor climber, but fearing that some day I might be called upon to climb, I took every opportunity to practice, but I am sorry to say I was in this a total failure; I never was able to get to the top of a telegraph pole, and this provoked me greatly, because some of the other boys could. However, my usual good fortune attended me; I escaped being called upon, and my deficiency in this respect was never known to the managers.

Of course, every ambitious messenger boy wants to become an "operator," and before the operators arrived in the early mornings the boys slipped to the instruments and practiced. This I did, and was soon able to talk to the boys in the other offices along the line, who were also practicing. One morning I heard Philadelphia calling Pittsburgh, and giving the signal "death message." Great attention was then paid to "death messages," and I thought I ought to try to take this one. I answered and did so, and went off and delivered it before the operator came. After that the operators sometimes used to ask me to work for them.

Having a sensitive ear for sound, I soon learned to take messages by the ear, which was then very uncommon—I think only two persons in the United States could then do it. Now every operator does, so easy is it to follow and do what any other boy can—if you only have to. This brought me into notice and, finally, I became an operator and received the enormous, to me, recompense of $25 per month—$300 a year! This was a fortune, the very sum that I had fixed when I was a factory worker as the fortune I wished to possess, because the family could live on $300 a year and be independent. Here it was at last! But I was soon to be in receipt of extra compensation for extra work.

The six newspapers of Pittsburgh received telegraphic work in common. Six copies were made, and the gentleman who made these received $6 per week for doing so, and he offered me a gold dollar every week if I would do the work, which I was very glad, indeed, to do, because I always liked to work with news and scribble for newspapers. The reporters came to a room every evening for the news which I had prepared, and this brought me into most pleasant intercourse with these clever fellows and, besides, I got a dollar a week as pocket-money, for this was not considered family revenue by me. I think this last step of doing something beyond one's task is fully entitled to be considered "business;" the other revenue, you see, was just salary obtained for regular work, but here was a "little business operation" upon my own account, and I was very proud, indeed, of my gold dollar every week.

The Pennsylvania Railroad, shortly after this, was completed to Pittsburgh, and that genius, Thomas A. Scott, was its superintendent. He often came to the telegraph office to talk to his chief, the general superintendent, at Altoona, and I became known to him in this way. When that great railway system put up a wire of its own, he asked me to be his "clerk and operator," and I left the telegraph office—in which there is great danger that a young may be permanently buried, as it were—and became connected with the railways.

The new appointment was accompanied by a tremendous increase of salary; it jumped from $25 to $35 per month. Mr. Scott was then receiving $125 per month, and I used to wonder what on earth he could do with so much money. I remained for 13 years in the service of the Pennsylvania Railroad Company, and was at last superintendent of the Pittsburgh division, successor to Mr. Scott, who had in the meantime, at Philadelphia, risen to the office of vice-president of the railroad.

Index to Volume XXVIII.

With this number of the ELECTRICAL REVIEW is issued an unusually complete and carefully prepared index to Volume XXVIII, which covers the period from January 1 to June 24, 1896.

Mr. John W. Lieb, Jr., has been appointed general manager of the Edison Electric Illuminating Company of New York, and will assume the duties of the late Harrison J. Smith.

Civil Service as Applied to Electrical Men.

The following is the list of questions used by the Civil Service Commission in the recent examination for an electrical expert for the New York State Railroad Commission:

1. State your age, education and experience in the electrical business. Give details of positions held and duties performed, with time and place.

2. Give names of your present and former employers in electrical work, with addresses.

3. What type of electric generator is generally used in the electric railway power house of to-day?

4. When more than one generator is used, what practice is generally followed in their operation?

5. Give sketch showing connections of two railway generators when operating on the same circuit.

6. Give list of the protective and controlling devices on a railway generator switchboard, with sketch showing connections of same.

7. (*a*) What method would you employ in insulating generator base from foundation? (*b*) Why?

8. How would you quickly ascertain that the generator and switchboard operating devices were properly installed and insulated from ground, while generator is in operation?

9. How would you ascertain if generator and switchboard operating devices are properly insulated from ground when generator is not in operation?

10. What would be good practice in supporting, locating and insulating wires from railway generators to outside circuits?

11. Explain methods employed to build up a generator when it fails to generate when running at normal speed.

12. Give full description of your method of figuring the amount of copper necessary for an even distribution of power on a trolley system with 10 per cent loss in lines.

13. What drop in potential does good practice allow in the rail and ground return?

14. Complete the connection between the overhead supply circuit and the return circuit through the car, with list of articles employed therein.

15. What safety devices should a motor car be equipped with, electrically?

16. What safety devices should a motor car be equipped with, mechanically?

17. What is your opinion of speeds for electric cars in cities of the second and third classes?

18. What is your opinion of fenders?

19. What is a guard wire for electric street railways?

20. What is your opinion of the utility of guard wires?

21. (*a*) What is the cause of shocks being received from electric railway tracks? (*b*) What is the remedy?

22. Give length and type of car, in your opinion, best adapted for ordinary street railway practice in cities of 100,000 to 500,000 inhabitants.

23. (*a*) What, in your opinion, is the best method of returning the current on a horse car road which is to be equipped electrically and is laid with flat rails on stringers, if such rails have an iron plate under each joint? (*b*) If no plates are under joints?

24. What direct-current potential would you consider dangerous to human life, and what is the case of the alternating current?

25. Explain the electrolytic disintegration of underground metallic conduits, by reason of leakages from railroad circuits. A complaint is made that a water pipe in a street upon which there is a trolley road is suffering from electrolytic corrosion. How would you determine whether the alleged corrosion was partly or wholly caused by electrolysis, and how would you determine the length of time the pipe would last under such action, and what means would you suggest for its partial or complete prevention? Should there be any communication between the rails and water or gas pipes, and if so, at what point?

26. To what would you connect the ground bus of the central station? Would you advise positive or negative terminals of dynamos to be connected to ground, and give your reasons?

27. What is meant by over-compounding, and what is its function in practice?

28. Describe the chief functions of a series parallel controller for street car motors.

29. How does the fluctuating character of an electric railroad load affect the choice of engines as regards condensing and non-condensing?

30. What factors determine the speed of a motor, and what factors determine its power? Give complete details and formulas.

Electrical Hardening of Steel.

A French technical journal announces a new invention in the field of electrical metallurgy. It is a process which will give an extraordinary hardness to steel. It is reported that the inventor, a Mr. Taux, has executed the following experiments before a committee of engineers at Strasburg. A drill hardened by electricity pierced a shell twice as quick as a drill of the best steel hardened in the ordinary way. The drill was closely examined afterwards by means of a strong microscope and not the least injury could be discovered. An electrically hardened circular saw cut iron bars with surprising ease. With a cold chisel similarly treated a steel bar, one by one-half inch, was cut through and the operation was repeated five times on the same bar. Then a cast-steel plate, one-quarter inch thick, was cut with the chisel, the edge of which showed neither a fissure nor any other alteration afterwards. An electrically hardened table knife cut iron wire of one-eighth inch diameter just as easy as a cotton string. The process is said to consist in the hardening of the red-hot steel objects in a conductive bath traversed by an electric current. If these tests should be confirmed by further practical experiences, the consequences would be of the greatest importance for the manufacture of tools.

A Progressive Telephone Company.

The Erie Telegraph and Telephone Company has sold the entire issue of $4,000,000 five per cent gold bonds, due in 1926, bonds to be delivered to the purchasers as funds may be required for extensions. This sale will give the company ample funds to carry on their extensions for the next seven years and enable them to retire their six per cent bonds, which can be called at 103 in 1899. The company has just purchased a building at Minneapolis, which is being remodeled and made fireproof, and will cost, when completed, $100,000. This company is very ably managed.

ALTERNATING-CURRENT STATIONS AND HIGH-VOLTAGE LAMPS.

BY H. W. COUZENS, BEFORE MUNICIPAL ELECTRICAL ASSOCIATION, ENGLAND, JUNE 10, 1896.

High-voltage lamps, as known at the present time, are unquestionably the offspring of the low-tension engineer. This may at first seem strange to an outsider, and, indeed, a contradiction in terms, but it is not at all to be wondered at when we consider the limited area which can be served by a 100-volt network. Indeed, this is so extremely restricted that, as soon as continuous-current low-tension electricity works of any magnitude came into existence, the three-wire system was brought out to extend the area of supply and mar the sweet simplicity of 100 volts all round. As these undertakings have grown and enlarged their borders, they have been driven to seek means to render a further increase of pressure commercially practicable, and this they have done with the aid of a 200-volt lamp.

But, although the alternating-current engineer is not "cribbed, cabined and confined" in this way, there are, I venture to think, cases in which high-voltage lamps may be of benefit to him, and I will endeavor, in a few words, to mention one or two such.

The standard practice for high-tension alternate-current work is to employ transformer sub-stations with a low-pressure distribution to consumers, but this has not hitherto been economically practicable in scattered residential districts, and distributed transformers have been the usual means of supply. With a declared pressure of 200 volts at the consumers' terminals, however, we can, of course, extend our mains four times as far each way, and the saving in capital outlay on the transformers will probably balance the cost of the low-tension network, and the standby losses of a number of small transformers with relatively large magnetizing currents will be wiped out. In this way the 200-volt lamp should greatly aid in demonstrating the marked superiority of the alternating current for electricity supply, for by its help, in almost any class of district, the benefits of low-pressure distribution to consumers, combined with the advantages of high-tension transmission, are secured. Furthermore, this low-pressure network is small and isolated, and, therefore, exceedingly unlikely to give trouble from leakage.

In the second case, where sub-stations are employed, but the distribution is at 100 volts and not on the three-wire system, though such is rarely the case at present. Where it does occur, however, it is a comparatively simple matter to double the pressure at consumer's terminals, thereby diminishing the current density in the mains and making the same main take a much larger lamp connection.

Thirdly, where the distribution from the sub-stations is on the three-wire system at present, the 200-volt lamp is still of service and will prove to be of great value if the life of the patent is prolonged. In the case of a local authority more especially, side streets in the neighborhood of the supply main can be lighted with incandescent lamps. Straggling consumers, also, at some distance from the mains, can be picked up, and there are many installations which it would not pay to connect at 100 volts and which yet would be profitable at the higher pressure.

In all instances it should be borne in mind that if by any means the cost in capital outlay be reduced (as I have endeavored to show) the consumer is bound eventually, though indirectly, to reap the benefit. This is certain to be the case whether the undertakers be a company or the local authority, though more especially in the case of the latter, on account of their high standing charges.

Perchance because they are sceptical as to its good qualities, the engineers of alternating-current electricity works appear to have taken comparatively little interest in high-voltage lamps up to the present time. The best known makers of this class of lamp incidentally gave the writer to understand, a short time ago, that their customers and the inquiries they received were at present almost exclusively from direct-current supply stations. Practical experience is the only proper basis of opinion on this question, and my own has been altogether favorable. This has not been due to any special care in arranging for the higher pressure, for the lamps have been affixed and the pressure doubled without touching in any way the wires or fittings, which have been of ordinary pattern. The new M-shaped double-filament lamp of Stearn's gives a useful and pretty effect when alight, and the eight-candle-power lamp is also a success, though the importance of this size of lamp is, I consider, somewhat overrated at present, for it is very difficult to get the average consumer to be satisfied with anything less than 16 candle-power in these days of increased illumination.

In conclusion, whilst to direct-current low-pressure supply the 200-volt lamp gives a new lease of life, not unattended with trouble in controlling 400 volts instead of 200, which is anticipated by the ever-vigilant Board of Trade, who are at present content with *not defining it as high-pressure*, the alternating-current engineer can reap its advantages without any additional drawbacks of like character, and the writer submits he will not be slow to do this in the immediate future.

DISCUSSION AS REPORTED IN LONDON "LIGHTNING."

Mr. R. C. Jackson said that he ventured to think the more important question was that of lamp efficiency. A 100-volt lamp was undoubtedly more efficient than a 200-volt lamp, and on the same basis a 50-volt lamp was more efficient than the 100-volt. He thought the time was not far distant when the gas companies would turn around and fight the electric supply concerns, and they had, therefore, to see how they would fare in direct competition. The only way they could fight and be quickly victorious was by using smaller candle-power lamps. His opinion was that high-voltage lamps would not be nearly so economical to the users as those of more modest voltage, and he did not see how they were going to get small candle-power lamps of four or five or six candles, which were necessary for economical bills, for the 200-volt supply. These matters, he thought, were of more immediate concern than the voltage in the mains. The question of determining the value under various conditions, and the duration, of the different forms and types of lamps, was one that required immediate investigation, and when it was determined, the matter of

pressure in the mains would fall into its proper place in due order.

Mr. J. H. Rider said it was rather amusing that the low-pressure men had now to confess that high pressure was right. (Laughter.) He maintained that, whether it was called 220 volts or not, 440 volts across the outers was *high* pressure and, in order to get the advantage of 220-volt lamps with mains of diminished size, the low-pressure men were willing to take upon themselves serious disadvantages. Alternating-current engineers had been termed "incandescent lighters," but it seemed to him that low-pressure engineers were taking upon themselves the same burden. (Hear, hear.) They were going to make themselves purely "incandescent lighters." Because they could get so many more consumers on a certain size main they were giving up altogether the small "arc" consumer and the small motor man. The consumers should have a voice in this matter, he thought. Low-pressure engineers were simply doing this for their own benefit, because at present they were confined to small areas; but they knew very well that they *must* go ahead, and so they were going into high pressure. (Cheers.) If they shut their eyes to the man who wanted one arc lamp, they were going the wrong way, for, unless they gave what the consumer wanted, they were not carrying out the chief condition of their existence. (Hear, hear.) It was all very well to say that it was for their advantage but he, Mr. Rider, declared that if he wanted a single arc lamp, he was not going to pay for four, and he certainly was not going to have his lamp run in series with the lamp of his neighbor, so that it would be put out when the latter did not want his light. So much of the alternating-current work was now done by low-pressure network that they had exactly the same advantage as the low-pressure men and, he maintained, none of the disadvantages. They could get any pressure they wished at the consumers' terminals, and they could supply current to one arc lamp as easily as a dozen. Low-pressure men were going to give high pressure upon a perfectly inflexible system. (Cheers.)

Mr. C. H. Wordingham said that it was not a question what was *going* to happen with the higher voltage, because at Manchester they had had it in practical operation. It was on account of the experience they had gained there, and their being able to point to accomplished facts, that the board of trade had been induced to raise the standard. They had had no trouble whatever. There was no difficulty in the way of distribution at 400 volts. He pointed out that the statement as to the old fittings being equally suitable to the higher voltage was a fallacy, and exhibited some specimen fuses originally made for 100 volts, which he had tried on a 200-volt circuit, one of which showed that the brass and copper had run together in one mass under the 200 volts. In every case the porcelain was smashed. He, Mr. Wordingham, was quite sure suitable fittings could be made, but careful regulations for insuring reliability should be drawn up. With regard to the point raised by Mr. Rider, he was of the opinion that any system, by which 100 volts could be directly supplied to the consumer, was a low-pressure system. He was quite sure that engineers would have trouble with their 220-volt supply in the shop districts and, in order to overcome the difficulty, he suggested the laying down of a pair of balancing transformers and the addition of two extra wires, and then they would be able to supply the arc lamps and motors. (Hear, hear.) He mentioned that he was advising the corporation to give a supply at 220 volts in the residential districts. He did not think that they should be called upon to give an infinite variety of pressures, which would be terrible from a commercial point of view and from a point of convenience. (Hear, hear.) One great advantage of the 400-volt supply was that it could easily be adapted for trams, and for street lighting it was excellent.

Mr. C. H. Stearn, speaking on the subject of the adoption of high-voltage lamps, admitted that there may have been some accidents and a few short circuits caused by them, but these things were not unknown with the old pressures. He did not think there was any increased risk in the higher voltage, but, even were there risks, that was no argument against high pressure. Taking up Mr. Jackson's suggestions, he did not think high-pressure lamps would become general if they had to abandon eight-candle power lamps, but there was no reason to do so. Experience had shown that diminution of section of the filament did not effect the life of the lamp, but, of course, if they took a very delicate filament and a strong one, the comparison was unfair. If the filaments were perfectly made, then the small 200-volt lamps would have as long a life as the 100-volt lamps. Naturally, if they decreased the section of the filament, they must have mechanical support. The argument had been used that they must have small lamps at the highest possible efficiency, but these high efficiencies were not in general use. It was quite evident that with three and one-half watts per candle they could satisfactorily use 220 volts. With regard to the higher efficiencies, there was no reason why they should not proceed further and have 16-candle-power lamps of about 3.2 or possibly three watts per candle. They must commence with an efficiency which was safe and then gradually advance. If they complicated matters they might do harm.

Mr. Alfred H. Gibbings remarked that from the discussion it appeared clear that the time had not yet come when definite opinions could be stated with regard to the use of high-pressure lamps, though he noticed that the views of the platform gentlemen very properly balanced. (Laughter.) The arc lamp question was the great difficulty, but at Bradford they now had machines on order that he thought would solve the difficulty by putting in an additional wire and balancing in the quarter of the town where the arcs were chiefly used. Even if they had to sacrifice efficiency to a slight extent, they gained advantage by getting extensions of their mains and so adding a class of consumer who was likely to aid in a reduction of the price charged. At Bradford they had got 385 consumers using high-pressure lamps and they never had any complaints. So far as Bradford was concerned, the proportion of eight-candle-power lamps to 16-candle-power lamps was so small as to cause no alarm. The exact figures were:

Size of lamp.		Number.
8-candle-power.		180
16	"	10,491
25	"	131
32	"	1,084
50	"	166
100	"	121
150	"	300
250	"	5
300	"	12

Mr. J. E. Stewart asked what was the effect of the induction of these 220-volt lamps upon the meter registration at Bradford. It would be interesting to know if the proper registration was affected.

Mr. Gibbings replied that he had carefully dealt with this matter and had not found that the meters registered wrongly.

Mr. W. Arnot recalled the numerous objections that were made against Mr. Swan's first lamp when he exhibited it at Glasgow, but all the difficulties that were then pointed out had been overcome. He was perfectly sure that in a few years they would find that 230-volt lamps would be much more used than the 100-volt. Much the same sort of discussion had taken place with regard to steam pressure. Many years ago they never thought of 300 pounds for working pressure, but he believed they would see that exceeded. Mr. Wordingham had said that the five-wire was the best system, and he, Mr. Arnot, supposed that he brought those sample fuses to demonstrate the fact. (Laughter.) He had no doubt that Sir Courtenay Boyle had taken due note of them. (Laughter.) It seemed to him, Mr. Arnot, that they were like the two political parties on this lamp question, but they must remember that they were not tied to any special pressure. They should advocate the supplying of electricity in whatever form or pressure was best suited to the district.

Sir Courtenay Boyle: I am extremely grateful to you for having given me the opportunity of listening to a most practical and useful discussion. I am astonished at the excessively valuable character which has distinguished the remarks that have fallen from the various speakers, and I am quite certain that such discussions must be useful, not only to the municipalities, not only to the government in the particular department which I serve, but will also be of advantage to that individual whom I have heard referred to in terms of unwonted respect—I mean the consumer. (Laughter.) Because, after all, we are all of us working in the interests of the consumer. (Hear, hear.) I do not mean to say that the interests of the producer are to be disregarded—quite the contrary; but we are working chiefly for the consumer, and to him we must look for the approval of our actions. I have heard the discussion so far, and I only wish my engagements would permit me to stay with you longer. You are dealing with a science which is still a young one, and there is much to learn by discussing your own experiences as you are now doing. I was somewhat appalled by Alderman Higginbottom's suggestion that the regulations are still in some respects very deficient, and that there are points that have not been dealt with. Well, we shall fully consider all the advice you can give us, and we shall be largely influenced by your opinions and recommendations. (Cheers.) The President, in his address, alluded to many subjects that are of considerable interest, but there are two small points which I offer for your consideration. Can nobody find a different name for "Board of Trade unit"? We go on talking about electricity, using this extremely incongruous term, but can no one suggest a better title? It may be interesting to you to know that I very nearly got it called a "Kelvin." Unfortunately, Lord Kelvin thought the course would be inadvisable, since he was associated with a supply meter about to be brought out and, therefore, his name could not be connected with a "Board of Trade unit." The board of trade must look to you gentlemen who are interested in the localities to guide us as to the behavior of current meters. You know that the Board of Trade are called upon to approve the pattern of meter, and at present we have considerable difficulty in discharging that duty. We must look to local bodies to tell us how these meters are behaving in practice—Major Cardew can easily tell you how they behave in the laboratory—and everything you do will be well done, if I can judge from the discussions to-day. I venture to offer you my hearty congratulations, and to urge you to continue the work you have undertaken, and if any support can be given to your deliberations by the department which I serve, it shall be readily accorded. (Cheers.)

Mr. Barnard, in reply to Mr. Rider, said that he thought the 220-volt system could not be quite inflexible, when it was so easily altered in central streets or central districts by means of the five-wire system in conjunction with motor transformers. This had been done in Bradford, and it was what he proposed doing in Hull in one particular district. It got over the objection of their being unable to supply 50 volts for a single arc lamp. With regard to small candle-power lamps, Mr. Gibbings had said they had only 180 in Bradford. He believed that in Hull theirs was a still smaller proportionate number. He did not think they should have two and one-half watts for an eight-candle-power lamp, nor did he think the consumers desired it. He thought they would find that they could rely on the makers to give them fuses that with very little alterations would answer for 200 volts.

Mr. Couzens said one predominant question seemed to be that of lamp efficiency raised by Mr. Jackson. He believed Mr. Jackson was engineer to a supply company, and probably the company supplied lamps to the consumers, but that, he believed, was not the general practice among corporations. They left the consumers to get their own lamps, and the consequence was that the consumer preferred a lamp that would last a long time to a lamp with a short life and a merry one. The consumer found a three and one-half-watt lamp the best, and that was precisely what he would get if he had a 200-volt instead of a 100-volt.

LITERARY.

Practical Building, New York, a new quarterly, has been received. It is neat and attractive, devoted to the details of construction and decoration.

How the free and unlimited coinage of silver would affect the American workingman is succinctly set forth by the Hon. Rowland B. Mahany, who furnishes a contribution upon "Sound Money the Safeguard of Labor" to the *North American Review* for July.

We are indebted to the Street Railway Publishing Company, of New York, for a copy of the annual edition of "American Street Railway Investments." This work is brought down to May 31, 1896, and is a very reliable and comprehensive publication. It contains the financial reports of 927 operating companies, 185 board companies and 307 new corporations, and includes a brief history of each, with nature of franchise, description of plant, names of officers, etc. It is a most excellent publication.

Judge Grosscup has enjoined General Electric Railway Company, of Chicago, from laying tracks on Fifth avenue from Thirty-seventh to Forty-third street on grounds that petition of property owners contained forged names.

TELEPHONE NEWS AND COMMENT.

Mr. James A. Morrisse is showing an automatic telephone switchboard in Paterson, N. J., with a view to installing an exchange at that point.

The Home Telephone Company has been granted a franchise in Baltimore, Md. The new company proposes to furnish telephones at $4 a month for offices and $3 a month for residences.

The stockholders of the Somerville & Raritan Telephone Company, New Jersey, which has been in business a little over a year, have sold their stock and transferred their company, with its property and business, to the New York & New Jersey Telephone Company. Treasurer Schwed said the company sold out simply because it didn't pay.

The National Telephone Construction Company, operating a telephone exchange at Waukesha, Wis., has ceased business. The exchange was built a few months ago to compete with the Wisconsin Telephone Company's exchange. The poles and wires have been sold at a nominal price, said to be enough to cover the outstanding indebtedness.

The American Electric Telephone Company, of Kokomo, Indiana, state that they have over 40,000 telephones and 200 exchanges in operation. P. C. Burns, the general manager of the company, is one of the most enterprising men in the independent telephone business, and it is largely through his energy and efforts that such an extensive business has been built up.

During the tornado in St. Louis three people were killed by poles, laden with overhead wires, falling on them, and many were injured. In addition, considerable damage was done to buildings by heavily ladened telegraph poles falling on them. Now there is an increased demand for burying the wires in St. Louis, and, as we understand it, that is what the electric companies want.

Mr. J. E. Keelyn, president of the Western Telephone Construction Company, of Chicago, and also president of the National Independent Telephone Association, has been doing some hard work in telephone circles in Minneapolis. His negotiations with local capitalists have progressed so far that he believes that an independent telephone company will soon be organized in Minneapolis and equipped by his construction company with the latest apparatus.

New telephone companies are keeping an eye on Indianapolis. The Phœnix Telephone Company and the Indiana Mutual Telephone Association are both applicants for franchises. The Central Union Telephone Company have an excellent exchange in the city, and, of course, are opposed to outsiders. Gen. E. P. Meaney, of the Long-Distance company, was a recent visitor to the Hoosier capital, and spoke eloquently of the advantages of his system, which is served through the Central Union.

Justice Davidson, of Montreal, last week dismissed the action of the Bell Telephone Company against the Montreal Street Railway Company. The telephone company sued the railway company for $30,000 damages, asserting that the introduction of the electric trolley car system into Montreal in 1892 caused and has been causing ever since serious disarrangement of the telephone service and necessitated the adoption of a number of expensive contrivances to counteract the effect of the presence of the trolley wires.

Considerable interest attaches to the sale of 4,255 shares of Bell Telephone stock in Boston on July 11. At the two previous auction sales of Bell Telephone stock 3,368 shares sold, February 9, 1895, at 189¼ to 191, and on October 30, 1895, 5,849 shares sold at 196. It is the opinion of Stock Exchange people interested in Bell Telephone, says the Boston *News Bureau*, that the stock to be sold July 11 will not go for less than 200. A syndicate of prominent banking houses will probably be formed to bid for it.

The following notice has been issued :

Subscribers and others having business relations with the Metropolitan Telephone and Telegraph Company, of New York city, are hereby notified that the telephone business of that company has been turned over to and will hereafter be conducted by the New York Telephone Company.

Contracts in force between the first named company and its subscribers and others have been assumed by the New York Telephone Company, to which has also been formally assigned all accounts due the Metropolitan company.

Checks in settlement of accounts should be made payable to the New York Telephone Company.

Address communications to the New York Telephone Company, 18 Cortlandt street, New York.

THE METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY.
NEW YORK TELEPHONE COMPANY.
New York, June 29, 1896.

A notice similar to the above from the Westchester Telephone Company has also been issued.

The Washington *Post*, in a recent issue, had a good deal of fun with a "deaf and dumb" telephone installation in the District building of that city, claiming that it did not, and could not, work, and that Messrs. Kennedy & DuPerow, the electrical contractors had been paid for something that was valueless. A few days later the paper took it all back, saying: "The facts in the case are completely at variance with all of the material statements made in the issue of June 14. The telephone lines in question are not useless; they have worked admirably and are now in first-class condition."

It is often best not to "know so many things that are not so."

Good News for the Directors of the Standard Telephone Company.

TO THE EDITOR OF ELECTRICAL REVIEW:

In answer to your open request as to what has become of the Standard Telephone Company, will say that the company is establishing its first great local plant in this city. Copy of charter and articles, which, by the way, are correct, from local press, showing work done to date, etc., inclosed. Sorry you don't read Philadelphia newspapers; they are great.

Yours respectfully,
A. T. NYE,
General Manager Standard Telephone Company.
Philadelphia, July 2.

ELECTRICITY SUPPLY AT TWO HUNDRED AND TWENTY VOLTS.

BY A. S. BARNARD, BEFORE THE MUNICIPAL ELECTRICAL ASSOCIATION, ENGLAND, JUNE 10, 1896.

The question of the most suitable pressure at which to supply current from a central station depends, of course, to a very large extent, on the area of the district to be supplied and the position of the central station. As, however, nearly all systems of supply include networks of distributing mains, which are maintained at about the same pressure as required by the lamps on the consumers' premises, and which networks are fed from sub-stations or generating stations, as the case may be, the writer proposes to deal chiefly with the advantages and disadvantages of the use of 220 volts on the distributing mains, without going very much into the question of whether it is better to have one or more low-tension generating stations to supply current to the network, or a high-tension generating station with a number of sub-stations.

In the first place, it should be remembered that it is not to the much-discussed new regulations recently issued by the Board of Trade that we owe the beginning of a new era, in which 200 to 220 volts will be the accepted standard of pressure for incandescent lamps, as 100 to 110 volts is at present. These regulations did not produce 220-volt lamps, and it is a pure chance that they happened to be under discussion just at the time when electrical engineers were considering the possibility of adopting a higher-voltage lamp and so relieving their over-crowded mains, or of reaching out to unexplored fields of action in the suburbs of the town. It naturally followed that engineers who had this in view were anxious to secure liberal clauses in these regulations, which should admit of the use of lamps at 220 volts on consumers' premises, and also of three-wire distribution in the streets (involving 440 volts across the outer cables) without being hampered or restricted by unnecessary precautions or expense in laying such cables, or in converting existing 110-volt systems to the higher voltage. In the end their efforts were mainly successful, though there are qualifications and conditions introduced which may in some cases prove almost insuperable difficulties in the way of changing over an existing system. It seems probable, however, that many engineers whose stations are at present working at 100 to 110 volts will manage to gradually persuade their customers that it is to their advantage to be supplied at 200 to 220 volts, or, if they are unable to do this, will, by appealing to their public spirit and representing the incalculable benefit of the change to the town, manage to obtain their consent to the change, and so overcome the difficulty of the proviso under Regulation B 6.

Whatever doubt may exist as to the benefits to the consumer of the higher voltage, there can be no question as to the immense gain to the supply works by its adoption. In the first place, should the Westinghouse company succeed in their application for a renewal of the three-wire patent, some stations having three-wire networks at 110 volts may find it worth while to discard their middle wire and adopt a two-wire 220-volt system, rather than continue to pay royalties on their mains. In the majority of cases, however, the change that will be likely to be made will be the doubling of the pressure throughout, making 400 to 440, or even 460, volts across the outer wires, with 200 to 230 volts at the consumers' terminals.

Briefly the advantages of the change will be as follows:—

1. Existing mains can supply twice as many customers, at the same time reducing the percentage of loss in the cables by one-half.

2. Variations and fluctuations, due to the switching on or off of motors or large groups of lamps, or carelessness in switching dynamos in or out at the station, are all reduced by at least one-half.

3. New customers can be supplied at a much greater distance from the station.

On the first point little need be said. In connection with most stations that have been in operation two or three years it has been found that some at least of the distributing mains were overcrowded, and needed either to be increased themselves or to be supplied by larger feeders. As electric light becomes more and more recognized as a necessity and not a luxury, this increasing of mains will be found to be a very heavy item of expenditure indeed; and any means by which twice the number of consumers can be supplied with the further advantage of reducing the percentage of loss, or four times the number of consumers with the same percentage of loss, will be gladly welcomed by the engineers responsible for furnishing a supply at an unvarying pressure to any number of persons who may apply for it.

It has been thought that the same end would be attained by the use of 110-volt lamps—the manufacture of which was to be so improved that they should give the same light with little over half the current they formerly took. Well, at present the best 220-volt lamps in the market take about three and one-half watts per candle-power, and the most efficient 110-volt lamps about two and one-half watts. That is to say, the 220-volt lamps will consume about 40 per cent more current than the high-efficiency 110-volt lamps. But how many consumers really prefer these high-efficiency lamps? Some do, no doubt, and congratulate themselves vastly on their reduced bills for current; but others, possibly the majority, prefer to use three to three and one-half watt lamps, which last longer, and do not cause the annoyance of continually burning out and having to be replaced. Both kinds of lamps are in use at Hull, and while, of course, there are many more of the high-efficiency 110-volt lamps than there are 220-volt, it is a significant fact that there has never yet been a single complaint made of these latter; whereas it never happens that a consumer complains of his lamps "giving out so quickly," except where he is using some specially recommended highest-efficiency lamp. Moreover, if we *must* have two and one-half watts per candle-power lamps, at any rate with 16 candle-power and all larger sizes, we shall in course of time get them, even at 220 volts. Even now it is only with the 8 and 16-candle-power lamps that there is any difficulty; and when they do come they will have a far better chance at 220 volts of obtaining the steady pressure, free from fluctuation, necessary for their economical use, than ever they have had at 110.

And now as to the second point—the reduced variations of pressure. Suppose a consumer having a motor or any other appliance taking 40 amperes at 100 volts is situated at the far end of a rather long main. When he switches the motor on or off he will very probably cause a "jump" in the neighboring lights, representing, perhaps, four volts, or four per cent of the standard pressure. If instead he were supplied at 200 volts, not only would his current be reduced to 20

amperes and the consequent variation in the voltage to two volts, but, as two volts is only *one per cent* of 200 volts, the effect on the lamps would be reduced to one-quarter, or, in nine cases out of ten, what was previously an annoying little flicker would become quite unnoticeable. Again, stations where a number of 100 volt machines are run in parallel are dependent upon the switchboard attendant, and perhaps some automatic device, to switch each machine in and out at exactly the right voltage. Now, every attendant has his own "co-efficient of personal error"—amounting to perhaps three volts, and even the best automatic switches have a similar margin to a greater or less extent. On a 100 to 110-volt system, a machine being switched in at 103 or 113 volts can be noticed at the lamps, and if, as sometimes happens, it is 105 or 115 volts, the effect is a decided jump in the light. On a 200 to 220-volt system the same errors will probably be made, but their effect will be reduced to one-half, as it is the *percentage* of variation in the pressure at a lamp that is noticed. Altogether, it seems to me that doubling the pressure at the lamps will make a marked and decided improvement in the steadiness, and will reduce the variation from the standard pressure at any point in the mains to a very great extent.

With regard to the third point mentioned—the advantages to be derived from changing over to 220 volts are so patent as hardly to need enlarging on. A station distributing at 110 volts on a three-wire system can supply an area of about one square mile—or, say, to a distance of about half a mile on all sides. To supply beyond this distance and maintain a reasonably constant pressure necessitates the use of such heavy copper mains and feeders as become almost prohibitory, and the point is very soon reached at which it pays better to adopt a high-tension system with transformers. Now, there are a number of low-tension stations throughout the country which have been established in the heart of the busiest quarters of the town, and which are supplying at 110 volts profitably and well. After a time, though, demands arise for current in the residential and outlying districts, and these demands have to be met. How shall it be done? By establishing a number of little low-tension stations all around the outskirts of the town, or by putting down a high-tension station to work independently of the existing station? Well, it seems to me that neither of these plans can compare in efficiency and low cost with that of doubling the pressure at the existing station, and so increasing the area over which its operations can extend. To what distance it is possible to supply economically at 220 volts can hardly be said to be settled as yet. Mr. Addenbrooke, in his recent paper before the Institute of Electrical Engineers, claimed that a 220-volt three-wire system could cover an area of 25 square miles from one station. No doubt it could, if the mains were heavy enough and the limits of variation in the pressure not too stringent. In changes of this sort, made by local authorities at any rate, two points should be kept in mind—first, improvement in the lighting service; second, economy in the capital outlay and working expenses. As regards improvement in regulation—if the present condition of things in most towns having a supply over an area of about one square mile, from one station, be the best that is obtainable at 110 volts, it would seem that too much loss has been allowed in the distributing mains, and the error should not be repeated when the area is being extended. When doubling the pressure, it will be quite enough to expect to be able to supply to double the distance with rather smaller mains—calculated to allow the same actual loss to the farthest lamp, as at present allowed to the farthest lamp in the small area—the percentage of variation in the voltage being then reduced to one-half of what it is at present. The writer would not care, therefore, to recommend attempting to supply much more than four square miles from one station or sub-station; and this could be done in the case of many existing stations by doubling the pressure, using mains which cost little over half as much as the mains laid in the business parts of the town, and yet reducing the loss and variation of pressure at the lamps to half the percentage obtaining at present. It must be borne in mind, too, that in cases of this kind the new area to be supplied will probably not be nearly equal to the present area in the number of lamps connected per yard of mains laid; and whatever basis is taken in determining the size of distributing mains to be laid in the business part of the town, it should be quite safe to take two-thirds, or even half, of that figure as the basis for mains laid in streets of villas, private houses, etc.

Of course there are many provincial towns—Hull is one of them—where the area of supply laid down by the provisional order is much more than four square miles. In a case of this sort the advantage of being able to reduce the number of generating or of sub-stations holds good as before. At Bradford, as stated by Mr. Gibbings, the new station is designed to supply to a distance of one and a half miles, over an area of about nine square miles, on the three-wire system with 230-volt lamps. Districts at a greater distance, in an area of about 17 square miles, will be supplied from the same station by means of motor transformers. This arrangement is practically identical with that the writer is recommending to the Hull corporation, except that it is not proposed to supply more than about four square miles without the use of transformers during the hours of heavy load.

The above remarks have for the most part referred to existing 110-volt systems, and the advantages they would derive from changing over to 220 volts. In the case of new works, not yet laid down, the advantages are much greater. It is well known what a heavy strain on the first few years' working is the payment of interest on, and redemption of, capital; and if by its means the expenditure in mains can be reduced by one-half, and at the same time a steadier and less variable light given to the farthest customers—who is there who would not favor the adoption of the 220-volt lamp?

(To be continued.)

The State of Ohio has contracted with the local lighting company for lighting the State House for the sum of $7,200 a year for 2,365 lights. This is pretty cheap lighting, and Ohio taxpayers ought to be pleased.

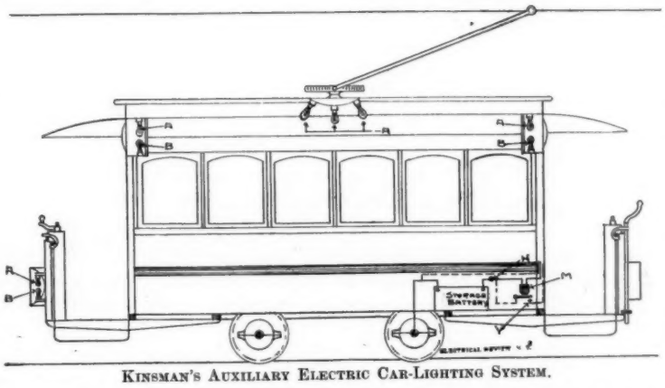
The Kinsman Electric Car-Lighting System.

This positive electric car-lighting system, owned by Mr. Frank E. Kinsman, of Plainfield, N. J., insures the electric light under all circumstances, being entirely automatic in operation, either in charging the storage batteries or lighting.

By the use of this system the car or headlight is never without electric light whether the trolley is on or off, or the power stopped for one minute or one hour.

The following description of the working of the system is given us by Mr. Kinsman:

By the present system of operating electric street cars, a shunt current is passed through five incandescent lamps to the rail or return circuit. In this system the current also passes through and lights these same lamps. It also passes through electro-magnet M, switch H, storage battery to axle of car wheel and rail to ground, energizing electro-magnet M, whose armature is drawn forward, at the same time charging the storage battery.



KINSMAN'S AUXILIARY ELECTRIC CAR-LIGHTING SYSTEM.

If the trolley comes off, the current gives out, or is interrupted in any way, the armature of magnet M is drawn back against its back stop Y, closing the supplemental circuit from the storage battery through switch H, to armature of Magnet M, back stop Y, lamps B B, returning to storage battery, thereby insuring light in the car whenever lights are required independent of the action of the trolley.

When the main circuit is restored by replacing the trolley, or otherwise, the current takes its original course through main circuit lamp, energizing magnet M (drawing its armature away from the back stop Y), storage battery and ground, recharging storage battery and lighting car as before, thus automatically and positively insuring a constant light in the car under all circumstances.

An experimental car with the above apparatus has been in successful use for some 18 months without any cost for repairs or maintenance.

A Correction.

In the ELECTRICAL REVIEW of June 24 appeared an illustration of the American stoker as applied to water-tube boilers accompanying an article by Mr. Albert A. Carey, on "Steam Boilers: Their Equipment and Management." Through a mistake in the figures in the copy of the paper sent us, the name "Murphy stoker" appeared beneath the illustration of the American stoker.

As we do not wish to have these excellent stokers mixed, we cheerfully make the above correction, which, however, the name on the cut practically did at the time.

ELECTRIC LIGHT FLASHES.

Ten thousand dollars is offered for an electric light plant at Mercer, Pa. Who bids?

The citizens of New Brunswick, N. J., are endeavoring to get the Beacon Lamp Company, of Boston, to locate in that city.

The Kingston, N. Y., Electric Light Company has just increased its capacity by 3,000 incandescent lights, making a total of 7,800 lights. A local paper speaks of its new "altermator."

Messrs. C. W. Boynton, Henry Maurer and Robert W. DeForest, with a capital stock of $150,000, have incorporated the Rahway, N. J., Electric Company, to furnish light, heat and power.

The Susquehanna, Pa., Electric Light, Heat and Power Company, will issue $20,000 in coupon bonds, in amounts of $100 each, payable $1,000 annually, with interest at six per cent, payable semi-annually.

The Boston Electric Light Company has declared its regular quarterly dividend of two per cent, payable July 15. Transfer books close July 1 and reopen July 15. President Gilbert and Treasurer Sias are to be congratulated over their magnificent property.

To hit the wrong man is always an injudicious course to pursue. A member of the Eastbourne Town Council has attacked the local electric lighting company for leaving the road in a bad state of repair after laying mains. Where the joke came in was that the council itself undertook the work in question for the company.—*London Electricity.*

Notice of application for a charter for the Elizabethtown Electric Light, Heat and Power Company, is given, the object of which is the supplying of light, heat and power by electricity to the boroughs of Elizabethtown and Mount Joy, Pa., and the townships of Coney, East and West Donegal, Mount Joy and Rapho. Application will be made this week, the incorporators being Isaac W. Hoffman, E. E. Coble, B. G. Groff, A. B. Demmy and others.

With an electric plant built at Vining's, on the Chattahoochee River, only seven miles from the city, and supplying power at less than one-half the cost of steam, the citizens of Atlanta, Ga., might reasonably expect to see a hundred new manufacturing enterprises established in their midst. Diversified industries are to the prosperity of a city what diversified farming is to the prosperity of agriculture. No city can become eminently great without them.—*Southern Architect.*

There are eight storage battery roads in Europe, four of which were installed during the past year. The largest system of this type comprises three roads in Paris, operating 19 storage battery cars, some of which have been doing duty since 1892, and the addition of a third road last May seems to indicate that for the conditions there existing the storage battery has proved satisfactory. The other four roads are located—one at Birmingham, England, one at Hague-Scheveningen, Holland, and two in Austria-Hungary.

ADVANCE INFORMATION

Valuable News and Tips for Manufacturers and Dealers.

We publish below information relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW.

Electric Light and Power.

HAWKINSVILLE, GA.—The Mayor may be addressed for information concerning electric light plant.

SISTERSVILLE, W. VA.—Johnson & Wood, of Pittsburg, Pa., will erect an electric light plant at Sistersville. Work will commence immediately.

CARTHAGE, MO.—Jasper County Light and Power Company has been incorporated by F. H. Fitch, Wm. McKinley, J. A. Banks. Capital stock, $30,000.

COLUMBUS, GA.—The Columbus Railroad Company has closed contract for the erection of a duplicate electric power plant, to cost $50,000.

SISTERSVILLE, W. VA.—McGhie & Moore, who were granted franchise for electric lighting, have contracted for a complete plant.

OMAHA, NEB.—Electric Mining, Milling and Power Company has been incorporated by W. B. Cheek, Alma Jackson, W. Musselman. Capital stock, $2,500,000.

MECHANIC FALLS, ME.—Oxford Electric Light Company has been incorporated, with W. A. Greenlaw, of Berlin, N. Y., president; H. C. Rowell, treasurer. Capital stock, $5,000.

FORT SCOTT, KAS.—Fort Scott Electric Light, Heating and Power Company has been incorporated by C. F. Drake, C. F. Martin, H. L. Page, Charles H. Gardner and G. D. Perrigo. Capital stock, $100,000.

CUMBERLAND, MD.—Steps are being taken to establish an electric fire-alarm service.

NORWAY, ME.—The Electric Light Company is building an addition to its station at Steep Falls.

MILWAUKEE, WIS.—An electric plant is to be installed at Whitefish Bay.

MERCER, PA.—An electric light company has been organized to furnish the city with light.

BASTROP, TEX. — The Bastrop Water and Light Company, of which Chester Echard is president, will add electric lights to its plant.

CALVERT, TEX. — The Calvert Water, Ice and Electric Light Company will increase its electric light plant.

CHESTER, PA.—The Beacon Electric Light Company, which recently secured the contract for lighting the streets of Chester, has purchased a site, and will shortly erect a large plant.

PANA, ILL.—The Pana Modern Electric Light Company has been granted a 20-year franchise.

DUNLAP, IOWA—The Dunlap Electric Light and Power Company has been granted franchise for constructing a $25,000 electric light plant.

CLOVERDALE, CAL.—The Riverside Water Company, J. H. Kleiser, superintendent, will add an electric light plant to its system.

NEW ALBANY, IND.—The New Albany Light, Heat and Power Company has been granted a franchise for lighting the four main streets of the city. Work will commence immediately, and be completed in 60 days.

HARTFORD, VT.—An electric light plant will be constructed.

NORFOLK, VA.—The Norfolk Gas and Electric Company, which was recently formed with a capital stock of $500,000, will build an electric plant.

SANTA CRUZ, CAL.—The Big Creek Power Company will extend its line for electric lights to Boulder Creek, Los Gatos, Saratoga, Santa Cruz and San Jose.

LAURENS, S. C.—R. H. Hudgins may be addressed for information concerning engine and boilers to be purchased for electric light plant.

SANTA ANA, CAL.—Edward Tedford, City Clerk, can be addressed for information concerning construction of electric light plant, for which an election will be held July 14, to vote on the issuing of $28,000 worth of bonds for that purpose.

New Electric Railways.

TACOMA, WASH.—The Tacoma Railway and Motor Company; Judge Hanford has signed an order allowing the receivers to enter into an agreement with the Commercial Electric Light and Power Company to furnish power to the latter company with which to operate its plant.

FLINT, MICH.—The Flint-Fenton Electric Railway will probably build electric road.

PARKERSBURG, W. VA.—The Ohio River Railroad Company will build a power station of 200 horse-power.

JACKSON, TENN.—J. H. Hunter, president of the Jackson & Suburban Street Car Company, has completed arrangements for the establishment of electric light plant.

MALDEN, MASS.—Malden Electric Company will erect a $10,000 building.

LEWISTON, ME.—Lewiston & Auburn Electric Railroad; N. Q. Pope and Col. F. W. Dana, of Boston, sold their entire holdings of the stock to Henry W. True, Esq., the present manager of the road.

HYATTSVILLE, MD.—The Columbia & Maryland Railway has let contract for the erection of $81,500 electric power house to Henry Smith & Son, of Baltimore. Machinery has been ordered.

FARMINGTON, MICH.—All the capital stock has been sold for the proposed Southfield & Royal Oak Electric Tramway.

WORCESTER, MASS.—A company has been organized to build an electric railway from Worcester to Clinton and Fitchburg. Capital stock, $150,000.

OSKALOOSA, IOWA—The City Council are now considering a proposition from the Oskaloosa Land Company, to erect and operate an electric street car line in this city.

PITTSBURGH, PA.—The Allegheny Traction Company will construct a line from Pittsburgh to Butler, Pa.

DOYLESTOWN, PA.—The Bucks County Railway Company has secured the right of way for an electric road to Willow Grove.

CHICAGO, ILL.—The Englewood & Chicago Electric Street Railway Company will erect a power house and car barn on Vincennes avenue, near Forty-eighth street. The cost of construction is estimated at $40,000.

REDWOOD CITY, CAL.—Mayor Sutro is interested in the proposed construction of an electric railway from San Mateo to Half Moon Bay.

ASHLAND, OHIO—The Ashland & Wooster Railway Company has been incorporated by Horace B. Camp, Charles Baird, Aaron Wagoner, William Buchtel and Thomas Walsh. Capital stock, $100,000.

THOMPSONVILLE, MASS.—The Enfield Street Railway Company will construct a trolley line from Thompsonville to Springfield as soon as they are granted authority.

FLINT, MICH.—A new electric railroad is to be constructed between Flint and Fenton, by way of Long Lake. Over $12,000 has been subscribed for that purpose.

New Manufacturing Companies.

RAHWAY, N. J.—Rahway Electric Company has been incorporated by Capt. Cassimer W. Boynton, of Boynton Beach, N. J., Henry Maurer and Robert W. Demorest, of New York. Capital stock, $150,000.

MANCHESTER, N. H.—Manchester Electric Company has been incorporated by William A. Tucker, Francis Peabody, Philip L. Salstonstall, Willis C. Bancroft. Capital stock, $40,000.

KENSINGTON, PA.—The Hunt Air-brake Company has let the contract for the erection of its plant at Kensington. The company will manufacture aluminum brakes for trolley cars.

MARIETTA, OHIO—The Marietta Electric Company has been organized with the following officers: President, A. L. Gracey; vice-president, Nelson Moore; secretary, J. S. H. Torner; treasurer, H. E. Smith; auditor, H. M. Dyar.

Electric Meters.

Mr. James Milne, in his paper on "Meters," before the Canadian Electrical Association recently, summed up the meter question in favor of the electrolytic meter as follows:

The advantages of the Edison chemical meter are:

1. Practically no loss.
2. No moving parts.
3. Absolutely correct at all loads.
4. Will record the smallest possible amount of current.
5. It is applicable to any pressure.
6. Low first cost.
7. Low cost of maintenance.
8. Readily repaired.

The only disadvantage (if any) is that the consumer can't read it for himself.

Motor Meters—The only advantage is that the consumer can read the meter.

The disadvantages are:

1. Loss in overcoming friction in the moving parts.
2. Incorrect at light loads.
3. Incorrect at quickly varying loads.
4. First cost high.
5. Cost of maintenance high.
6. Not readily repaired.

Clock Meters—In the Aron type of meter we have the following advantages:

1. Correct at all loads.
2. Will record the smallest possible current.
3. As a coulomb meter it is applicable to any pressure.
4. Practically no loss.
5. Can be read by the customer.

The objections to this meter are:

1. Liability to stop recording if clock stops.
2. First cost high.

We, therefore, see as a practical meter the chemical meter is superior in every point, save one, and that is the customer can't read it for himself. Is this much of an objection? How many gas consumers read their meters? I know I am not very far out when I say that not over two per cent ever wish to read their meters.

The Edison meter has been condemned by a certain class either through ignorance of its principle or prejudice, and our Canadian Government have also seen fit to practically condemn it—probably not condemn it, but to curtail the growth of a meter that has no superior and very few equals.

Inferior Incandescent Lamps.

The predictions which were made on the expiration of the master patent for the electrical incandescent lamp, with regard to the probable influx of cheap and inferior foreign-made lamps, have, on the whole, been fairly fulfilled, says London *Industries*. Yet the trade in these is probably not anything like that anticipated. The major portion of these come from Germany. Generally speaking, they are photometrically delusive, because, though they may be marked 16 candle power, it is exceedingly seldom that the light comes up to this standard. In the tests recently made, it was found that many of these lamps took six watts, and gave only about seven or eight candle power. The "useful life" of a lamp should be at least 600 hours. The duration of many cheap German lamps has been proved to be only 70 hours.

KINDRED INTERESTS

The Michigan Central, known as the "Niagara Falls route," continues to send to its numerous friends a neat monthly diary. It is the best thing of the kind issued and is always appreciated by every recipient.

The Seymour Manufacturing Company, of Seymour, Ct., are enlarging their boiler house, and the new portion of the building will be constructed entirely of steel in order to make it absolutely fire-proof.

"Business is booming," says the Stanley Electric Manufacturing Company, of Pittsfield, Mass. The way modern electrical apparatus is being turned out by this progressive company, it is evident that the quoted words are those of truth and soberness.

Metropolitan Electric Company, Chicago, have taken the northwestern agency of the Missouri Telephone Manufacturing Company, St. Louis, Mo., and are carrying a full line of their justly celebrated telephones, switchboard apparatus and patent gravity hook. All telephones are guaranteed. Correspondence will be answered promptly.

The West Shore Railroad Summer Schedule went into effect Sunday, June 28. The Catskill Mountain Express, which leaves New York at 10.45 A. M., will hereafter be known as the Rip Van Winkle Flyer. Both the time and service of this train has been greatly improved. The Saturday half-holiday express will leave New York at 1.00 P. M., and reaches the principal Catskill Mountain points in time for supper. There has also been added a sleeping car, which will leave New York on the 3.15 A. M. train, reaching the Catskill Mountains in time for breakfast Sunday morning; the sleeper can be entered at 9.00 P. M. Saturday night. A return train will leave Catskill Mountain points late Sunday night, arriving in New York early Monday morning in time for business.

A Small Fire at the American Electrical Works.

On June 26 a fire broke out in the drying room of the great wire factory of the American Electrical Works, Providence, R. I., and did about $1,000 worth of damage, fully covered with insurance. A small wooden shed used for storing wire was entirely destroyed, and a portion of the inside of the drying room was damaged, together with a lot of wire, which was destroyed by having the insulation burned off and being wet. As showing the excellent management of these works, the fire was confined to the drying room, and was extinguished by the employés with their own fire apparatus. President Eugene F. Phillips was at his Montreal factory at the time, and was, of course, greatly pleased to learn that the damage was so slight. Some of his friends, when the fire was first reported, supposed he was beginning to celebrate the Fourth of July with his new firearms, a specimen of which was recently sent to his numerous friends.

The Electric Appliance Company's Agencies.

The Boudreaux dynamo brush is so well known at home and abroad that the Electric Appliance Company, of Chicago, feel that it is only necessary for them to state they have taken the general western agency and are carrying a complete stock in Chicago. These brushes are used almost exclusively by the United States Government and by the largest manufacturers of electrical machinery in the United States, and are known as the great commutator savers.

The Electric Appliance Company have also taken the general western agency for the Armorite iron-armored interior conduit which is creating a very great deal of favorable comment, on account of its many unique and desirable features. One of the great points claimed is that the conduit can be bent cold into almost any shape, thus saving the expense of elbows and greatly reducing the time required to install the conduit.

The company consider Armorite a "winner."

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Expensive Telephony.

[From the Chicago Times-Herald.]

Hobson stutters. Hobson is a first-class business man, and his vocal infirmity has never interfered until recently with the profits of the well known firm, Hobson & Dobson.

Hobson is a progressive man, ever on the alert to adopt modern methods. He was one of the first local subscribers to the telephone, and has kept right up with the march of inventions in all its ramifications. As a wide-awake man Hobson was not slow to grasp the possibilities of the long-distance telephone. And that is how Hobson & Dobson came to have the first dispute which marred years of profitable partnership.

Dobson went to New York last week. He made his headquarters at a well known Gotham hotel and telegraphed Hobson of his arrival in the Eastern town. It seemed that an Eastern customer failed to keep a certain agreement, the details of which were familiar to Hobson but not to Dobson. It would take a long telegram to explain the details fully, and Hobson decided to call Dobson up on the long-distance telephone. The rate for conversation between Chicago and New York is $8 for five minutes, after the proper connections are made and communication established. The usual negotiations passed between the operators, and Dobson recognized the voice of his partner.

"Hello, Hobson!"

"H-h-hello, D-d-dobson: is that y-y-you?"

"Yes, it's me. Talk fast, Hobson; this costs money."

"I know it does. You know H-h-h-hammers-s-stein and P-p-p-pollosky?"

"Who?"

"H-h-h-h-h-hammers-s-s-stein and P-p-p-p-pollosky?"

"Hammerstein and Pollosky? Yes, they bought $4,000 worth of goods from us. What about them?"

"Have j-j-j-just r-r-r-received a l-l-l-l-letter f-f-f-from H-h-h-h-hammerstein saying t-t-t-that P-p-p-p-pollosky r-r-r-r-refuses to—"

"Say, Hobson, you had better ring off, now, and save money. It makes no difference how long or how short this message is, we are bound to get the worst of it. You don't stutter on a telegraph blank, and I can not understand the cipher system you have been sending. Don't get hot about it, old man, but write it out and send it over the wire. Good-by."

"G-g-g-good-b-b-by. Y-y-y-you will b-b-be s-s-s-sorry for t-t-this."

Hobson hung up the receiver and paid the $8. He is waiting for Dobson to return.

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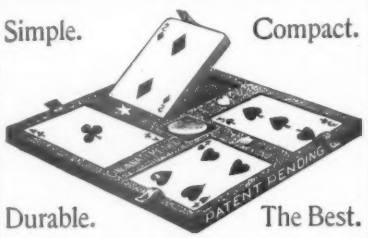

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On May 1st the offices of this journal were removed to the well known and modern *Times* Building, at the junction of Park Row and Nassau street, a few numbers above our former address.

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The Wayne County Telephone Co. Fairfield, Ill., have purchased and installed a full "Western" equipment to take the place of a so-called "genuine Hunnings" outfit, which latter failed to work after a short use.

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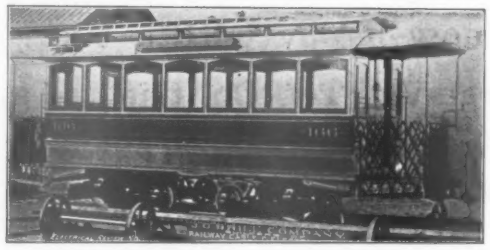

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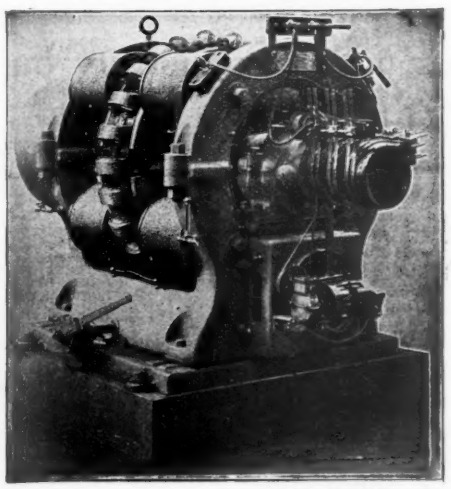

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